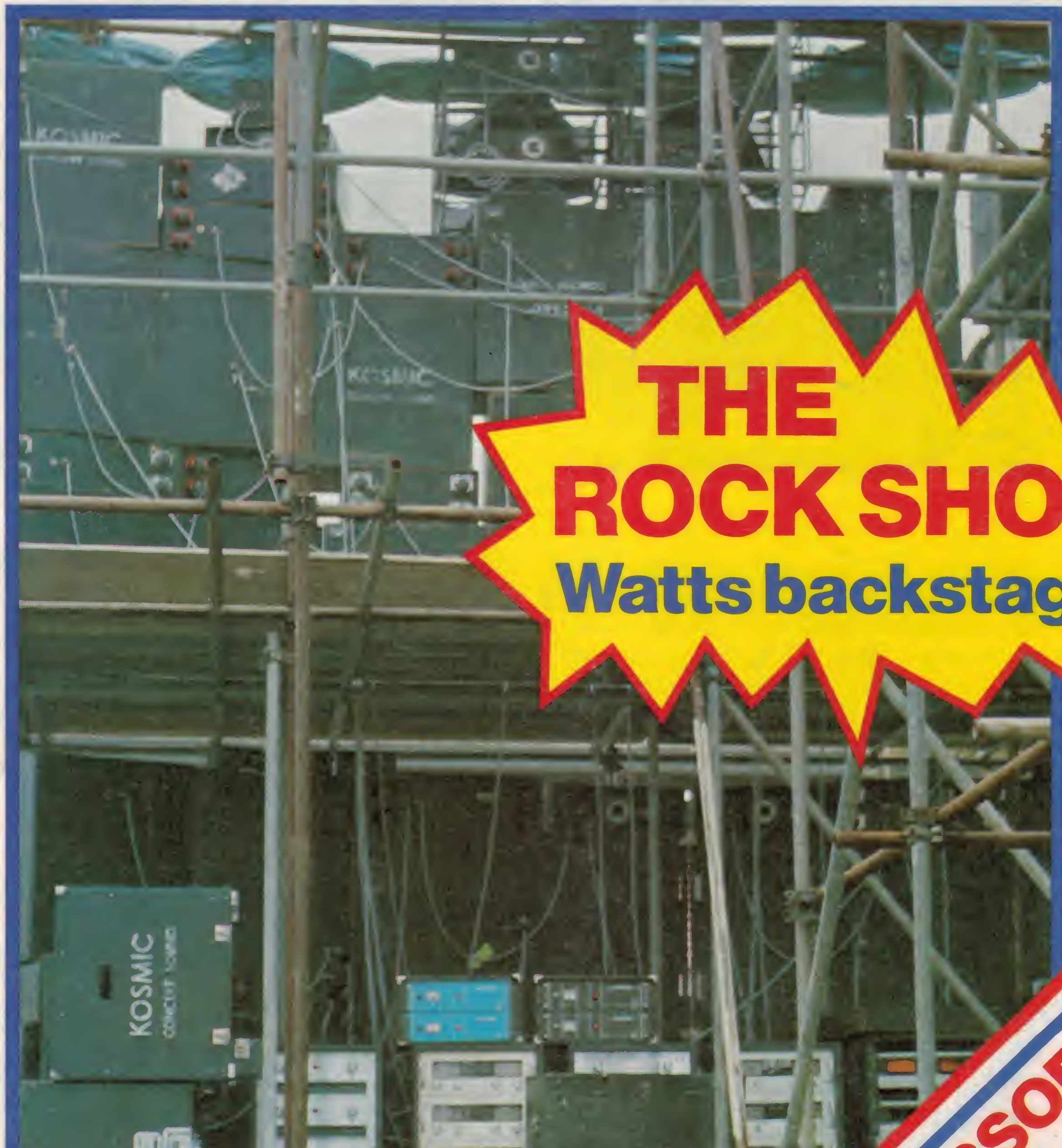
APRIL 1977 $1.00*
NZ $1.15

electronics TODAY INTERNATIONAL

Registered for posting as a publication – Category C



THE ROCK SHOW
Watts backstage

PROJECT: PHASE METER

CB ACCESSORIES surveyed in CB AUSTRALIA FREE INSIDE

WHY YOUR NEXT CASSETTE SHOULD BE A MAXELL UD

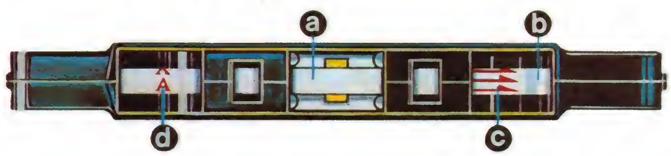
1 THE RESEARCH — More than twenty years ago, Maxell produced their first reel of magnetic tape. At that time, Maxell made a commitment to produce and sell only the finest magnetic products their technology could create.
That commitment still stands today.

2 THE TAPE — This continuous research has lead to the development of the Maxell UD (ultra dynamic) cassette. A tape that has a coating of super-fine PX gamma ferric oxide particles with an extra smooth mirror-finish surface.
All of this adds up to high output, low noise, distortion free performance and a dynamic range equaling that of open reel tapes.

3 THE SHELL — Even the best tape can get mangled in a poorly constructed shell. That's why Maxell protects its tape with a precisely constructed shell, made of lasting heavy-duty plastic.
No fixed guide posts are used. Instead Maxell uses nylon rollers on stainless steel pins thus eliminating the major cause of skipping, jumping and unwinding.
A tough teflon (not waxed paper) slip sheet keeps the tape pack tight and flat. No more bent or nicked tape to ruin your recording.
Maxell doesn't use a welded seal, but puts the cassette together with precision screws. Result — Maxell doesn't jam.

ULTRA-DYNAMIC UD

4 THE LEADER — A leader tape that has a four function purpose.
a) Non-abrasive head cleaning leader (cleans recording head for 5 secs.).
b) 5 second cueing line (recording function starts 5 seconds after the line appears).
c) Arrows indicating direction of tape travel.
d) A/B side mark (indicates which side is ready for play).



Now you know why your next cassette should be a Maxell UD (ultra dynamic).

maxell®

The sound expert's cassette. UD available in C60, C90 and C120.
Distributed by **Hagemeyer (Australasia) B.V.** Branches in all States.

WT GD 127M

electronics TODAY INTERNATIONAL

A MODERN MAGAZINES PUBLICATION

APRIL 1977, Vol. 7 No. 4

Editorial	Steve Braidwood
Publisher	Collyn Rivers

Electronics Today International is Australian owned and produced. It is published in Australia, Britain and Canada and is the fastest growing electronics magazine in each country.

Next month is a SPECIAL MONTH for PROJECT BUILDERS

Look at these planned projects:

* 100 W 12 V PA Amplifier
* High-Power Strobe
* Transistor Assisted Ignition
* Induction Balance Metal Locator

all in May's ETI.

COVER: Guess how many watts — 2,000, 5,000? Suppose we tell you that these loudspeakers were one of two arrays that were used to bring the sounds of Rod Stewart to over 30,000 people at the Sydney showground, now guess — then turn to page 17 and see if you were right.

*Recommended retail price only

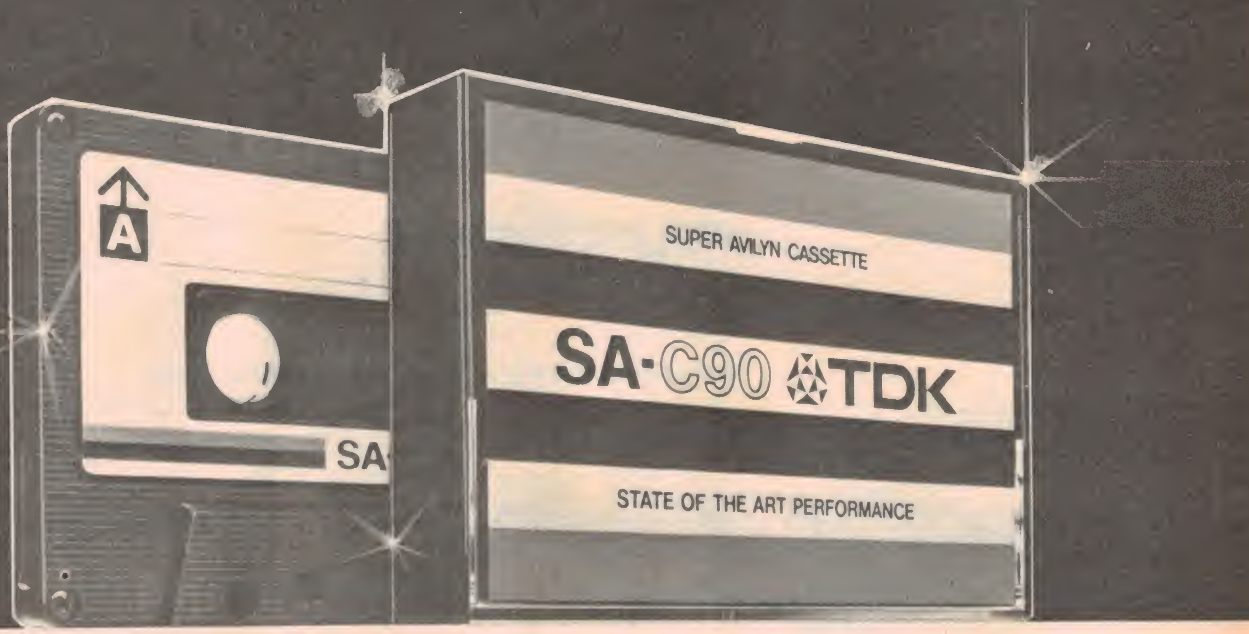
PROJECTS

FEATURES

NEWS & INFORMATION

Free Inside . . . CB Australia looks at CB Accessories

TDK SUPER AVILYN! THE EXPERT'S CHOICE



This is what the experts say:

MR. E. NAKAMICHI, PRESIDENT, NAKAMICHI RESEARCH INC.

"TDK Super Avilyn cassettes are recommended for use with all Nakamichi tape decks. Before leaving our factory, all Nakamichi equipment has the bias set for TDK SA to achieve optimum performance."

ELECTRONICS TODAY APRIL 1976

"Listening tests proved that Super Avilyn tape sounds as good as its measured performance indicates. Background noise is substantially lower than other tapes and the dynamic range is unquestionably better. Frequency response is excellent."

HI-FI REVIEW JULY 1976

"TDK Super Avilyn lived up to its reputation in these tests. For the uncompromising tape enthusiast it is one of the best cassette tapes available. Its price is very competitive making this tape good value for money in the high performance range. For the perfectionist, TDK's hard to beat."

LOUIS CHALLIS & ASSOCIATES, CONSULTING ACOUSTICAL AND VIBRATION ENGINEERS.

NATA LABORATORY APPROVED.

"TDK Super Avilyn looks like being one of the most important advances in tape formulation in the mid 70's."

TDK®

SOLE AUSTRALIAN AGENTS:
CONVOY INTERNATIONAL PTY. LTD.
4 DOWLING STREET WOOLOOMOOLOO 2011. TEL. 357 2444
MELBOURNE OFFICE 31 COVENTRY ROAD SOUTH MELBOURNE TEL. 699 4188

Wait till you hear what you've been missing.
Available at all good record bars and hi-fi stores.

NEWS DIGEST

CB to be legalised?

Unofficial sources are predicting the legalisation of CB on the 23-channel, 27 MHz, band sometime in the next month. By the time this issue is available the NCRA and the WIA should have made their submissions to the government, and the minister for Posts and Telecommunications should be ready to put his department's proposals to the cabinet.

Most people feel that the CB service will be based on the old US system – which would mean CBers could use only equipment which is approved by the P&T department. Some publications have been advising their readers not to buy gear before the legislation is introduced and type approvals issued, because they might be buying set which doesn't meet the standards.

We feel that the P&T department is unlikely to impose standards that are stricter than those they are using for other 27 MHz gear in today's licensed services. So we're guessing that there will be very few, if any, sets banned.

However, we do not recommend that you buy gear in anticipation of legalisation. For one thing, you might have your rig confiscated and be charged in court with maintaining an unlicensed station (even if you never use the gear). And no-one is yet sure that the 27 MHz service will be legalised.

As far as UHF (or VHF) is concerned there is little speculation – many have proposed that a second band be initiated (perhaps with a phase-out of the 27 MHz service) but we'll have to wait and see.

WIN A UNITREX CALCULATOR!

February's contest was so popular that we're setting a similar puzzle this month (see page 11 for February's result). This contest was submitted by J.T. Broekstra of Gladstone, Queensland.

Each letter below represents a unique decimal digit and none of the numbers in the sum start with zero. Given that N is not equal to four, what are the numbers that correspond to each of the letters?

```
 SEVEN
 THREE
   TWO +
TWELVE
```

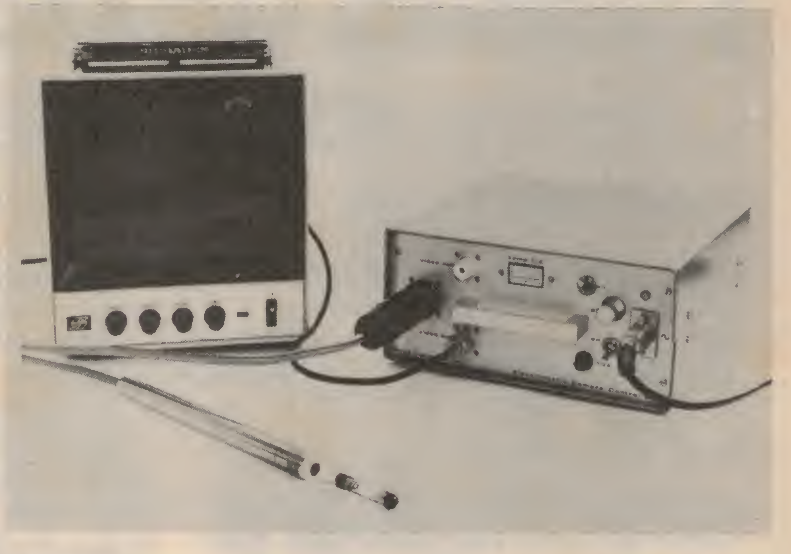
The winner will be the sender of the first correct entry drawn at random after the closing date, 15th May. Send your entry on the back of an empty envelope to ETI/Unitrex Contest, ETI Magazine, 15 Boundary Street, Rushcutters Bay, 2011.

Melbourne's Computer Club

The first meeting of the Microcomputer Club of Melbourne was held on 19th March. We have no details of future meetings but interested readers are invited to phone Roger Edgecombe during office hours, on 836 1077.

The Sydney area club is going strong with meetings on the first and third Mondays of each month at the WIA Hall, 14 Atchison Street, Crows Nest.

TINY CAMERAS



A range of the smallest industrial closed circuit television cameras in the world is now available from AWA Rediffusion who have recently been appointed agents for Rees Instruments Limited (UK).

These miniature television cameras are coming into increasing use to check faults in industrial pipelines which are otherwise inaccessible for inspection. Cameras, as small as a pocket torch and carrying their own lighting, can be inserted more than 130 metres into pipes and tubes.

One camera in the AWA Rediffusion range has a diameter of 17.3 mm. They are not only used to check for corrosion and faults, but also to locate foreign bodies and guide the placing of tools and remote handling equipment.

The cameras are also suitable for inspecting in dangerous environments, such as checking fuel elements in nuclear reactors.

BENCH SUPPLIES FOR MICROPROCESSOR-SYSTEM DESIGNERS

Two new compact dc power supplies from Hewlett-Packard each provide adjustable output voltages. Output ratings of Model HP 6236B are 0 to 6 V at up to 2.5 A and 0 to 18 V at up to 1 A for Model HP 6237B. Both bench supplies also have plus and minus outputs of 0 to 20 V at 0.5 A that track one another within 1 percent. However, by using the continuously adjustable tracking-ratio control, an operator can set any negative output voltage between 5 percent to 95 percent of the positive output. As the 20 V control is adjusted, the negative output will be proportionately less than the positive output as determined by the tracking ratio setting. A three-position meter switch selects the desired output for display of voltage and current on dual panel meters.

The new supplies are for use in designing and testing electronics devices that require symmetrical operating voltages and in applications where opposite polarity but asymmetrical voltages are required.

Duty-free price of each model is $390. Duty and Sales tax are additional, if applicable.

For further information contact Hewlett-Packard Australia Pty Ltd, 31-41 Joseph St. Blackburn, Victoria, 3130.

Car Cassette/Cartridge Player

Rising Electronics of 4 Wewak Place, Allambie Heights, Sydney have a novel player for motorists who are changing their tape system from cartridge to cassette: the CT702 will play your old cartridges and your new cassettes. Not only is the machine a tape player — it will also receive AM and FM (stereo) radio. The 10 W output unit sells for $245.

WARNING

OPERATION ELECTRONICS

The recently published School Electronics Kit called **OPERATION ELECTRONICS IDEAS BOX** contains a number of mains-operated projects that can become *potentially lethal* under certain fault conditions.

MacMillan of Australia, the publishers, advise particularly that Project 42 'Motor Speed Controller' *should not be constructed.* Although credited to *Electronics Today International* the circuit as published by MacMillan differs substantially from the original which appeared in the Oct 1974 issue of *ETI*.

RECALL OF CIRCUIT CARDS

In the interests of safety, MacMillans are recalling all kits so that the mains-powered project cards can be removed and the kits sent back to purchasers. Teachers should note that neither the *manual* nor the battery-powered projects are affected.

PROCEDURE FOR RETURNING CARDS

Those schools in possession of MacMillan's **OPERATION ELECTRONICS IDEAS BOX** should return *the cards only* (not the *manual*) to their original supplier, together with the supplier's invoice (or an on-approval invoice in the case of inspection copies). They will be suitably credited. If you receive a kit from a bookseller, return it to him not MacMillan of Australia.

FURTHER INFORMATION

If purchasers are unsure as to what to do, they should contact Sydney 929-4278: Melbourne 699-8922: Brisbane 398-6543: Adelaide 42-2640: Perth and Hobart ring (03) 699-8922 or write to . . .

MacMillan of Australia, 107 Moray Street, South Melbourne, Vic. 3205.

COUNT CORVUS turns a blind eye to devaluation!

Our No.1 rated scientific

CORVUS CALCULATOR

is only $79·95

Believe it – despite devaluation this magnificent instrument is at a lower price than before. It will solve the most complex scientific and business calculations. You can just imagine what worlds we might have conquered if it had been invented 100 years ago!

THE MANY OUTSTANDING CORVUS FEATURES INCLUDE:

- 14 digit display
  12 digit business mode plus sign
  10 x 2 Scientific mode plus sign Mant + Exp
- 12 digit accuracy
- Reverse Polish Notation (4 stack)
- 10 addressable memories (incl. Last X) with memory to X exchange on all memories
- Radian mode
- To and from Radian Conversion
- Sigma plus standard deviation and mean
- Trig functions plus inverse and hyperbolic
- Range up to ± 200 exponential value
- Fixed, floating and scientific decimal point mode
- Percent – percentage difference
- π constant (11 digit accuracy)
- Natural and base 10 log and anti-log
- To polar – to rectangular conversion
- Vector additions
- All functions of X from and to
- 8 decimal conversions
- Ni-cad batteries
  AC/DC adapter charger
- Soft carrying case
- 1 year full warranty

Corvus Calculators are also available at all **Sydney Wide Stores.** For Victorian readers at **The Calculator Supermarket, 274 Lonsdale Street.**

Other Corvus Calculators available
804D for business, home and school **$14**
615 Business Statistician **$19.95**
610 Financial GENIUS **$74.95**

Please send me by return mail the No. 1 Rated Scientific CORVUS CALCUALTOR for only **$79.95** plus $2.50 postage and handling. I am enclosing ☐ cheque ☐ money order ☐postal note for ☐calculator(s).

Bankcard Mail Order facility – please complete.
Please charge my Bankcard.

bankcard

Bank ____________
Bankcard No.____________
Expiry Date____________
Signature____________

NAME. . . . .
ADDRESS. . . . .
. . . . .Postcode . . . . . .

ELECTRONIC CONCEPTS PTY LTD
Ground Floor, Cambridge House,
52-58 Clarence St., Sydney 2000.
Tel: (02) 29 3753

Money back guarantee if returned in original condition within 14 days.

TV Game

'Playtech by Telesport' are manufacturing and marketing this video game based on the GI IC used in the ETI Selecta-Game. The company's address is PO Box 161, Caulfield South, 3162.

Stereo microphones/ headphones

A new product from JVC (Japan), distributed by Hagemeyer, is the HM200E binaural headphone-microphone set. This way you don't need a dummy head to make stereo recordings — you use your own!

The headset looks like an ordinary pair of headphones with some strange contouring on each of the earpads. This is the simulated ear and simulated ear canal which surrounds the microphone.

Maybe someday they'll invent one which uses the real ear.

"ARIX" MULTIMETER

The 100 movement of the Arix 36FTR is protected against overload by diodes. In addition the rest of the components are protected by a fuse.

There are 34 ranges: DC from 0.5 — 1000 V (25 kV with optional HT Probe) 10 A to 10 A.

AC 5-1000 V, 10 A, Resistance 5 to 50 M Decibels, -10 to +62

A Transistor Tester is also incorporated. The meter is particularly useful for TV testing as DC readings are not affected by HF components. This is achieved by a special circuit arrangement.

Spare parts and repair service is available in Australia and the instrument is covered by a 3 month's warranty by the sole distributor: Indeva Pty Limited, 24 Bellevue Road, Bellevue Hill. NSW 2023.

Underexposed?

In ETI's March issue we forgot to credit the cover photographer, George Hofsteters, and his model, Neville St John, for their excellent work.

Watch for Lithium Batteries

A problem with LED watches has always been the heavy drain on the small batteries — which means a short battery life. A new battery has been developed to improve this situation.

National Semiconductor have announced their intention to use lithium batteries in their future watches; these batteries give more power in less space than conventional batteries. Mallory have exhibited one miniature lithium-iodide battery which is capable of delivering 200 mA hours at two to three volts.

Progressive Stereo Radio

A new group of enthusiasts in Melbourne, who call themselves the Progressive Broadcast Service, are planning to start an FM station to provide 'professional' rather than 'commercial' programmes. Finance is expected to come from the audience and already the group has recruited the services of experienced production staff.

Their address is PO Box 275, Malvern 3144.

Dick's DIY PCB Sheet

Another 25 cent Do-It-Yourself leaflet from Dick Smith is now available. Three A4 sides and 20 illustrations show you how to make your own printed circuit boards.

RS-232 Floppy Disc

Anderson Digital Equipment has just announced the release of the Techtran 9512 Micro Disc. The 9512 is a serial RS-232 ASCII floppy disc system. It records on an IBM Compatible Diskette.

Further information from Anderson Digital Electronics, Sydney 439 5488, Melbourne 543 2077.

New 1296 MHz World Record

On February 25th this year VK6WG in Albany and VK5QR in Enfield (a suburb of Adelaide) made a world record contact on the 23 cm band. The 1886 km QSO involved VK6WG using CW and WK5QR using SSB. The previous record was 1240 km. Each station used a 3 ft dish antenna and 10 to 15 W of RF.

EEEMC'77 EXHIBITION IN SYDNEY

The 3rd International Electrical Electronic Engineering, Measurement & Control (EEEMC) exhibition (the industry's major biennial event) will be held from 18-21 October, 1977, at the R.A.S. Showground, Sydney.

The EEEMC Exhibition will now be held over four days and will include power generation, industrial process control, transmission and distribution, automated and control systems, scientific and industrial instrumentation, electrical and electronic equipment and components, security systems, lighting, accessories and supporting services. Companies or individuals who wish to have further details are invited to write to the executive director, EEEMC'77, PO Box 259, Roseville, 2069 or telephone 02 — 467 1949).

ETI READ BY MANY

The February Unitrex calculator contest asked for a solution to the following sum:

```
   ETI
  READ
   BY+
  ----
  MANY
```

There are, in fact, eighteen solutions we know of, but following B.J. Joyce's advice that each of the four numbers is divisible by three reduces the number of solutions to twelve. The following readers supplied all twelve solutions: Leon Piotrowski of Ashfield, NSW, A.G. Loveday of Toowoomba, Queensland, and R.E. Davids of St Ives, NSW.

Here are the solutions:

0	A	B	B	B	B	N	T	T	Y	Y	Y	Y
1	I	D	D	N	N	I	D	Y	A	A	A	N
2	B	N	R	D	I	R	A	B	N	N	R	T
3	T	Y	N	A	A	M	R	D	B	I	M	B
4	Y	T	N	R	R	A	M	R	D	T	D	D
5	E	R	A	M	M	Y	B	M	E	E	E	A
6	N	M	Y	E	E	E	E	A	I	B	I	I
7	R	A	E	T	T	B	Y	I	T	D	T	E
8	M	E	T	I	D	T	N	E	R	R	N	R
9	D	I	I	Y	Y	D	I	N	M	M	B	M

There were 450 entries with these correct solutions and we also received six entries with the following solutions which do not meet the divided-by-three criterion:

0	A	A	N	T	Y	Y
1	I	T	A	R	A	T
2	Y	R	B	M	B	D
3	T	M	I	N	R	D
4	B	I	Y	I	E	M
5	E	E	E	B	M	A
6	R	D	T	D	N	N
7	M	B	D	A	I	E
8	N	Y	R	E	R	Y
9	D	N	M	Y	T	B

These solutions were only sent in by one person each. The Unitrex calculator goes to the sender of the first correct entry drawn at random: Mr A. Hunt of Brighton Beach, Victoria.

MISCALCULATION. . .

'The Corvus 500 is a lot more calculator for $79.95. Price . . . $95.00. That's how the ad (ETI February and March, 1977) reads. The $79.95 is correct but the $95 was a mistake made by the production people, who have asked us to print this apology. The Corvus 500 is available from Electronic Concepts Pty Ltd, 52-58 Clarence St, Sydney.

SUGGESTION FOR SPEAKER MANUFACTURERS

Here is a suggestion from one of our readers:

I have constructed a pair of Magnavox MV50 loudspeakers for use with my 422 amplifier and am most pleased with the combination.

Recently one speaker developed a buzz and inspection revealed two tiny slivers of metal being held against the dome of one of the tweeters by the speaker's magnetic field. Presumably these particles came from the mounting screws used to hold either the baffle or the speakers themselves.

A suggestion in your magazine that non-ferric materials be used in these situations may prevent others from experiencing this problem.

John Rankine

ERRATA

Parts List ETI 482A Jan 77
'Q1,2 BC549' should read 'Q1-Q4 BC549'

Parts List — Circuit Diagram ETI 132
RV2 should be 10 k not 2k2.

NATIONWIDE ELECTRONICS

P.O. Box 184, Pennant Hills, 2120
PHONE 635-4648

Nationwide Electronics would like to announce that their new store at Parramatta (Harris Park) will soon be open for business. Although we do not have a full range of stock as yet we can always order it in for you if you would like to write or phone for service — Bill and Norm Edge.

TRANSISTORS

	Type	Nearest Equivalent	PNP	NPN	CASE	Vcbo. V.	Vceo. V.	Ic. A.	Ptot. (W)	Tamb.°C	LFE min-mar	IC mA	fT. typ. MHZ	Price
Low Frequency Sml	BC107	BC547,BC182		√	T018	50	45	0.1	0.3	25	110-450	2	300	.21
	BC108	BC548		√	T018	30	20	0.1	0.3	25	110-800	2	300	.21
	BC109	BC549,BC1846		√	T018	30	20	0.1	0.3	25	200-800	2	300	.22
	BC177	BC557	√		T018	50	45	0.1	0.3	25	75-260	2	150	.21
	BC178	BC558,BC327	√		T018	30	25	0.1	0.3	25	75-500	2	150	.21
	BC179	BC559	√		T028	25	20	0.1	0.3	25	125-500	2	150	.22
	BC639			√	T092	100	80	1.0	1.0	25	40-160	150	130	.51
	BC640		√		T092	100	80	1.0	1.0	25	40-160	150	50	.51
	BDY92			√	T03	100	80	10	40	75	30-120	5	70	$4.68
	BD135			√	T0-126	45	45	1.0	8	70	40-250	150	250	.64
	BD136		√		T0-236	45	45	1.0	8	70	40-250	150	75	.64
	BD137	BD139		√	T0-126	60	60	1.0	8	70	40-160	150	250	.75
	BD138	BD140	√		T0-126	60	60	1.0	8	70	40-160	150	75	.75
	BD139			√	T0-236	100	80	1.0	8	70	40-160	150	250	.83
	BD140		√		T0-126	100	80	1.0	8	70	40-160	150	75	.83
	BD266B		√		T0-220	100	100	8	60	25	750	3	100	$3.61
	BD267B			√	T0-220	120	100	8	60	25	750	3	100	$3.61
Deflection Transistors	BF115			√	T0-72(2)		30	30mA	0.145		45-165	1	230	.94
High Frequency Transistors	BF173			√	T0-72(2)		25	25mA	0.26		38	7	550	$1.08
	BF180			√	T0-72(1)		20	20mA	0.15		13	2	800	$1.08
	BF199			√	T092(1)		25	25mA	0.5		37	7	550	.45
High Power OP	MJ2955	2N5871	√		T03	70	60	15	115	25	20-70	4A	4	$1.70
Audio Driver Switch	TT800	MU9660	√		T039	60	60	1	0.8		40-120	100	100	$1.20
	TT802	MU9610		√	T039	80	60	1	0.8		40-120	150	60	$1.20
High Power Output	2N3055	TIP33A BCY20		√	T03	100	70	15	115	25	20-70	4A	70.8	$1.20
RF-IP Amp.	2N3564			√	T0-106	30	15	0.1	0.2	25	20-500	15	400	.65
Switch & Amplifier	2N3566	BCY71		√	T0-105/6	40	30	0.2	0.3	25	150-600	10	40	.75
	2N3638A	BC177	√		T0-105/6	25	25	0.5	0.3	25	100	50	150	.45
Switch	2N3640	BCY72	√		T0-105/6	12	12	0.08	0.2	25	30-120	10	300	.55
Switch & Amplifier	2N3642	BC337		√	T0-105/6	60	45	0.5	0.35	25	40-120	150	250	.55
	2N3643			√	T0-105/6	60	30	0.5	0.35	25	100-300	150	250	.50
	2N3645	2N2905A	√		T0-105/6	60	60	0.5	0.3	25	115-300	500	200	.55
Low F Def.	2N3693	BC547		√	T092	50	45	0.1	0.5	25	110-220	2	300	.28
High Power Output	2N3789	AY9149	√		T03	80	60	15	115	25	20-150	4A	4	$1.80
Transmitting Transistors	2N4427	BLY88A		√	T039		20		1				175	$2.68
	2N5590			√	SOT-48/2		18	2A	15		5	.5	175	16.00

SPECIAL TYPE TRANSISTORS

Type	Description	Price
BPX66P	Light activated switch (SCS), VAK, VKA = 70V, 1A = 150mA, IARM = 2.5A	$6.43
BRY39	Trigger device, TO-72(3) case, VGA = 70V, VGR = 5V, IARM — 2.5A, PTOT — 275mW	.92
D13TI (2N6027)	Programmable UJT	$1.35
MFE131 (BFR84)	MOS FET TO72(6) case, VDS = 20V, PTOT at Tamb = 300mW at 25°C, IDSS = 20.65mA	$1.83
MPF102	F.E.T.	.65
MPF103	(2n5457) F.E.T.	.85
MPF104	(2N5458)F.E.T.	$1.00
MPF105	(2N5459)F.E.T.	.60
MPF106	(2N5485)F.E.T.	$1.00
MPF121	F.E.T.	$1.50

Signal Diodes

Type	Description	Price
BA102	Variable Capacitance (silicon)	.39
BA219	Whiskerless small signal (silicon)	.20
OA47	Gold bonded (silicon)	.29
OA90	General purpose VR ¾ 20V, IF ¾ 8mA (Germ.)	.15
OA91	General purpose VR ¾ 90V, IF ¾ 50ma (Germ.)	.18
OA95	General purpose VR ¾ 90V, IF ¾ 50mA (Germ.)	.20
IN914 (IN4148)	Whiskerless small signal (Sil.) switching	.15

CMOS IC's

Type	Description	Price
74C00	Quad 2 Input NAND gate	.55
74C02	2 Input NOR gate	.80
74C08	Quad 2 input AND gate	.55
74C30	8 input Pos. NANDgate	.60

LINEAR IC's

Number	Case	Description	Price
CA3028A	T05	Differential/cascode amplifier	$2.60
CA3089			$2.90
CA3130T	T05	F E T operational amplifier	$2 25
LH0070-2		"dc Volt. ref uses precision regulator" — June 1976 ea	P O A
LM301A	8DIL	General purpose operational amplifier	.75
LM309K	T03	5 volt regulator (metal case)	$3.55
LM317K		Adjustable 3 terminal regulator "Regulated Power Supply" — Aug '76 EA	$5.95
LM341P		5.0 5V/½A regulator I C	P.O.A.
LM380	14DIL	5W power audio amp	$2.40
LM1351	14DIL	"Derived Frequency Reference" — July '76 ea	$1 90
LM3900	8DIL	Quad Operational Amplifier	$1 75
MC1310P (x R1310P)	14DIL	"FM Stereo Decoder" — April 75 EA	$3.50
NE555	8DIL	Timer	70
NE556	14DIL	Dual Timer	$1 80
NE567	8DIL	"Sync-a-slide" Auto Slide Advance — June '76 EA	$3.80
OM190		Hybrid V H F amplifier	$11 50
OM802	T018	Timer	$3 20
SAK140	16DIL	"Tacho for Tune Ups" — Oct 75 EA	$3.09
SCL5411		"Quartz Crystal Drive for Fluorescent Readout Clock" — Sept 75 EA	$3 75
SL440	14DIL	"Autodim" — Jan 76 EA	$1 90
S50242		"Electronic Organ" March 76 EA	$14 80
TAA300	T05	0 5 watt Audio Amp	$4 53
TAA550	T018	Voltage Stabiliser	89
TCA220	16DIL	Operational Amplifier (Triple)	$2 75
TBA810A		7W Audio Amp	$2.59
UAA170	16DIL	16 LED Display Line Driver	$3.25
UAA180		LED DRIVER	$3 25
UA709	14DIL, T05	High performance op amp	86
UA723	T05	Voltage regulator	$1 09
UA739	14DIL	Dual low noise op amp	$2 50
UA741	8DIL	Frequency compensated op amp	75
ULN2208		"I F Strip with Dec for FM Stereo Tuner" — 75 EA	$2 38
ZN414	T018	Complete radio chip	$3 95
11C90		"High Speed Prescaler" — Aug 76 EA	$18 00
566		"Function Generator" — 76	P.O.A
7805	T0220	Plastic 5V regulator 3 terminal	$2 95
7812	T0220	Plastic 12V regulator 3 terminal	$2 95
7815.	T0220	Plastic 15V regulator 3 terminal	$2 95
8038	14DIL	"Function Generator" — Feb 76 EA	$8 13

LOCMOS IC's

Besides all the advantages of CMOS — such as low power dissipation, high d.c. fan-out, simple power supply, inputs and outputs protected against electrostatic voltages — the LOCMOS range also gives you buffered outputs on all circuits, higher speed, higher packing density — essential MSI/LSI better noise immunity. They are plug-in replacements for the 4000 and 14500 ranges.

Number	Description	Price
HEF 4000	Dual 2 in nor ⅛ inv.	.66
HEF 4001	Quad 2 in nor	.66
JEF 4002	Dual 4 in nor	.66
HEF 4011	Quad 2 in nand	.66
HEF 4013	Dual D F/F	$1.09
HEF 4016	Quad bilat. switch	$1.19
HEF 4017	5 st. johnson ctr.	$2.73
HEF 4021	8-bit s.r.	$2.73
HEF 4023	Triple 3 — in nand.	.66
HEF 4024	7 st. binary ctr.	$2.11
HEF 4027	Dual J-K F/F	$1.29
HEF 4028	1 of 10 decoder	$2.11
HEF 4029	Sync up/down ctr.	$3.10
HEF 4071	Quad 2-in or.	.66
HEF 4081	Quad 2-in and.	.66
HEF 40097	3-S Hex non-inv. buffer	$2.21
HEF 40163	4-bit sync binary ctr./syn.	$3.54
HEF 4511	BCD to 7 seg. latch/dec/dr.	$3.91
HEF 4518	Dual bcd up ctr.	$3.30
HEF 4520	Dual binary up ctr.	$2.97

SPECIAL IC's

Type	Description	Price
MM5314	Clock chip 6 digit, 12 or 24 hour format, 50 or 60 Hz input. "Flour readout LSI Digital Clock" — April '75 EA	$6.50
MA1002B	N.S. Clock module. "Modular Digital Clock" — Dec. EA '76	$11.50
2513	64 x 8 x 5 character generator	P.O.A.
2102	1024 — bit static ram	$4.80
8038	Function Generator (Intersil)	$8.13

DIODES

Silicon Rectifier Diode Bridges

Type	Price
MB1 (WO2) 100 PIV 1.5A	$1.18
MB4 (WO4) 400 PIV 1.5A	$1.26
MB10 (SB10) 1000 PIV 1.5A	$2.56
PA40 400 PIV 8A	$5.85
PB40 400 PIV 25A	$7.00

Silicon Rectifier Diodes

Type	Price
EM402 (IN4003) 200 PIV 1A	.15
EM404 (IN4004) 400 PIV 1A	.20
EM410 1000 PIV 1A	.30
A15A 100 PIV 2.5A	.55
BYX2IL/200 200 PIV 25A	$2.57
BYX2IL/200R 200 PIV 25A	$2.57
Heatsink BYX2IL	.90

Zener Diodes

Type	Price
BZX79 Series 400 mW from 4.7V to 33V	.30
BZX70 Series 1.7 watt from 8.2V to 33V	.99
BZY96 Series 1.25 watt from 3.3V to 7.5V	$2.25

Tunnel Diode

BB105G SOD-23 Case, VR=28V, V=25V, (Variable Capacitance) .49

Low-Power Schottky TTL

Type	Description	Price
74LS00	Quad. 2-input positive NAND gate	.67
74LS04	Hex inverter	.71
74LS08	Quad. 2-input positive AND gate	.67
74LS14	Hex Schmitt trigger	$3.37
74LS74	Dual D-type edge triggered flip-flop	.91
74LS92	Divide-by-twelve counter	$2.31
74LS161	Synchronous 4-bit binary counter	$3.77
74LS195	4-bit bidirectional universal shift registers	$3.20
74LS367	Hex buffer/inverter	$2.22
74LS368	Hex buffer/inverter	$2.22
9602B	Dual retriggerable monstable multivibrator	$2.95

TTL IC's N74 Series

Number	Description	Price
7400	Quadruple 2-input positive NAND gate	.48
7401	Quad 2-input pos. NAND gate with open coll. output	.48
7402	Quad. 2-input pos. NOR gate	.48
7404	Hex inverter	.48
7405	Hex inverter with open coll. output	.48
7410	Triple 3-input pos. NAND gate	.48
7413	Dual NAND Schmitt trigger	$1.14
7437	Quad 2-input pos. NAND buffer	.89
7441	1 of 10 decoder/driver	$2.15
7473	Dual JK master-slave flip-flop	.80
7476	Dual JK master-slave flip-flop	.90
7486	Quad 2-input Exclusive — OR gate	.84
7490	Decade Counter	.88
7493	4-bit binary counter	$1.20
7496	5-bit shift register	$2.14
74156	2-line to 4-line decoder demultiplexer	$2.22
74164	8-bit parallel-out serial shift register	$2.60
74193	Synchronous 4-bit binary up/down counter	$2.99

Delivery Instructions — No minimum charge $0 — $5 = 50c, $5.01 — $15.00 = $1.00, $15.01 — $25 = $1.50, $25.01 — $50 = $2.00, $50.01 — $100 = $3.00, $101 or more = $4.00 — all above charges are by post. All reasonably light parcels can be sent C.O.D. at no extra charge — except Post Office collection charge ($1.50). This C.O.D. service is unique — just pick up your telephone and we'll despatch same day if ex-stock. "No desposit" required. All heavy items will be sent "Freight — ON" through Comet Transport. No packing charges. Please send an extra $2.00 if insurance is required.

RIP OUT TO RAMSGATE AND RIP US OFF

(WE'RE AN EASY TOUCH)

Resistors:

All values to ¼ & ½ watt. 3c each. 100 up 2.5c each. Power: 5 watt. 0.1 to 10 preferred values. 45c each. 10 up 40c each.

Capacitors:

Ceramics: All preferred values from 1 pf to 0.033 uF. 10c each. 25 up 8c ea. 0.047 to 0.1 uF. 17c ea. 25 up 15c ea. 0.47 uFd 30c ea. 25 up 25c ea.

ELECTROLYTICS:

Value	Voltage	1 off	25 up
1 μFd	6.3 Axial	15c	13c
2.2 μFd	25 p.c.b.	10c	8c
3.3 μFd	25 p.c.b.	10c	8c
4.7 μFd	10 p.c.b.	10c	8c
4.7 μFd	25 p.c.b.	10c	8c
22 μFd	10 p.c.b.	10c	8c
22 μFd	50 p.c.b.	17c	15c
25 μFd	16 p.c.b.	10c	8c
33 μFd	6.3 p.c.b.	11c	9c
33 μFd	16 p.c.b.	12c	10c
47 μFd	10 p.c.b.	14c	12c
47 μFd	25 p.c.b.	16c	14c
47 μFd	50 p.c.b.	17c	15c
100 μFd	10 p.c.b.	16c	13c
100 μFd	25 p.c.b.	18c	15c
220 μFd	6.3 Axial	20c	17c
220 μFd	16 p.c.b.	20c	17c
220 μFd	35 p.c.b.	26c	22c
470 μFd	6.3 Axial	25c	22c
470 μFd	25 p.c.b.	25c	22c
			10 up
1000 μFd	10 Axial	38c	35c
1000 μFd	16 p.c.b.	40c	36c
1000 μFd	25 p.c.b.	52c	47c
1000 μFd	35 p.c.b.	52c	47c
1000 μFd	50 p.c.b.	89c	80c
2200 μFd	50 upright	$1.80	$1.60
3300 μFd	50 upright	$2.05	$1.75
3300 μFd	75 upright	$2.70	$2.40

SEMI-CONDUCTORS:

T.T.L. Digital	1 off	10 up
7400	40c	35c
7402	40c	35c
7404	40c	35c
7408	40c	35c
7410	40c	35c
7420	40c	35c
7430	40c	35c
7447	$1.50	$1.40
7451	40c	35c
7454	40c	35c
7474	90c	85c
7490	80c	75c
7492	80c	75c
74107	$1.00	90c
ULM 3000S (Hall effect switch)	$6.00	$5.50

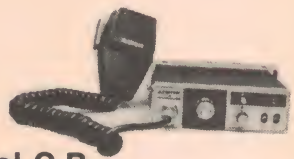
C/MOS

	1 off	10 up
4000	40	35
4001	40	35
4002	40	35
4006	2-50	2-25
4007	40	35
4008	2-75	2-50
4009	80	70
4011	45	40
4012	40	35
4013	1-00	90
4014	2-25	2-05
4016	85	75
4017	2-25	2-05
4018	2-50	2-25
4021	2-30	2-10
4022A	1-90	1-70
4023A	45	40
4024	1-35	1-20
4027A	1-00	90
4028A	1-90	1-70
4030A	80	70

LINEAR

	1 off	10 up
LM301	70	60
LM304	1-30	1-20
LM305	1-20	1-10
LM307	70	60
LM308	2-30	2-10
LM309K	2-80	2-60
LM319	2-80	2-60
LM324	3-20	3-00
LM339	3-20	3-00
LM377	2-80	2-50
LM380	1-50	1-35
LM382	2-45	2-30
LM3900	1-50	1-25
LM555	85	75
LM566	4-50	4-30
LM709	45	40
LM723	1-00	90
LM741	45	40
8038	6-95	6-50
LM1458	1-50	1-30

TECHNICAL ADVICE FREELY AVAILABLE



RIP OFF NO. 1

AIMOR 23 channel C.B.

Dual conversion with act. delta tune & P.A. facility. 5 watts input. Sensitivity luV at 10 dB s/n. **$98.00** $2.50 P&P. Including base loaded antenna.

RIP OFF NO. 2

The mystery S.S.B. rig. Can't show you a picture because they were still at the airport when this ad. was compiled. But they're a great performer at only **$239.00** $2.50 P&P.

AND NOW THE BIGGEST RIPOFF OF THEM ALL

EVERSONIC ST12

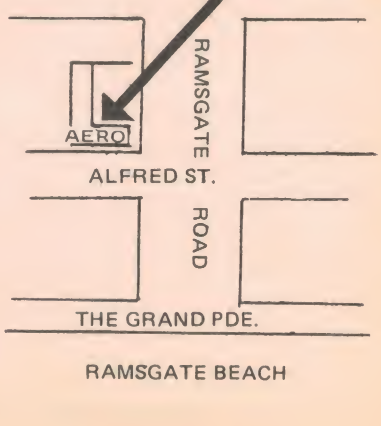
Great unit at only **$69.00** $2.50 P&P. (We've got to move these to pay for ripoff No. 2)

AND OF COURSE THE CONTINUING RIPOFF

ON S.W.R. meters **$28.50,** Helical antennas, complete with cable, plug & base **$28.50.** And many other items, pots, etc.

STUDENTS:

On presentation of your registration card or your enrolment slip we will offer you a discount.



OR RUSH REMITTANCE FOR OUR RAPID MAIL ORDER SERVICE

(Min. mail order $5.00, some items limited stock)

(add $1 P&P for items not otherwise marked)

P.O. Box 38, Ramsgate, 2217

AERO ELECTRONICS

Shop 13, 191 Ramsgate Road, Ramsgate.

Phone (02) 529-7438

(Cnr. Alfred St. Behind Commonwealth Bank)

bankcard welcome here

8.30 — 5.30 Mon-Fri.

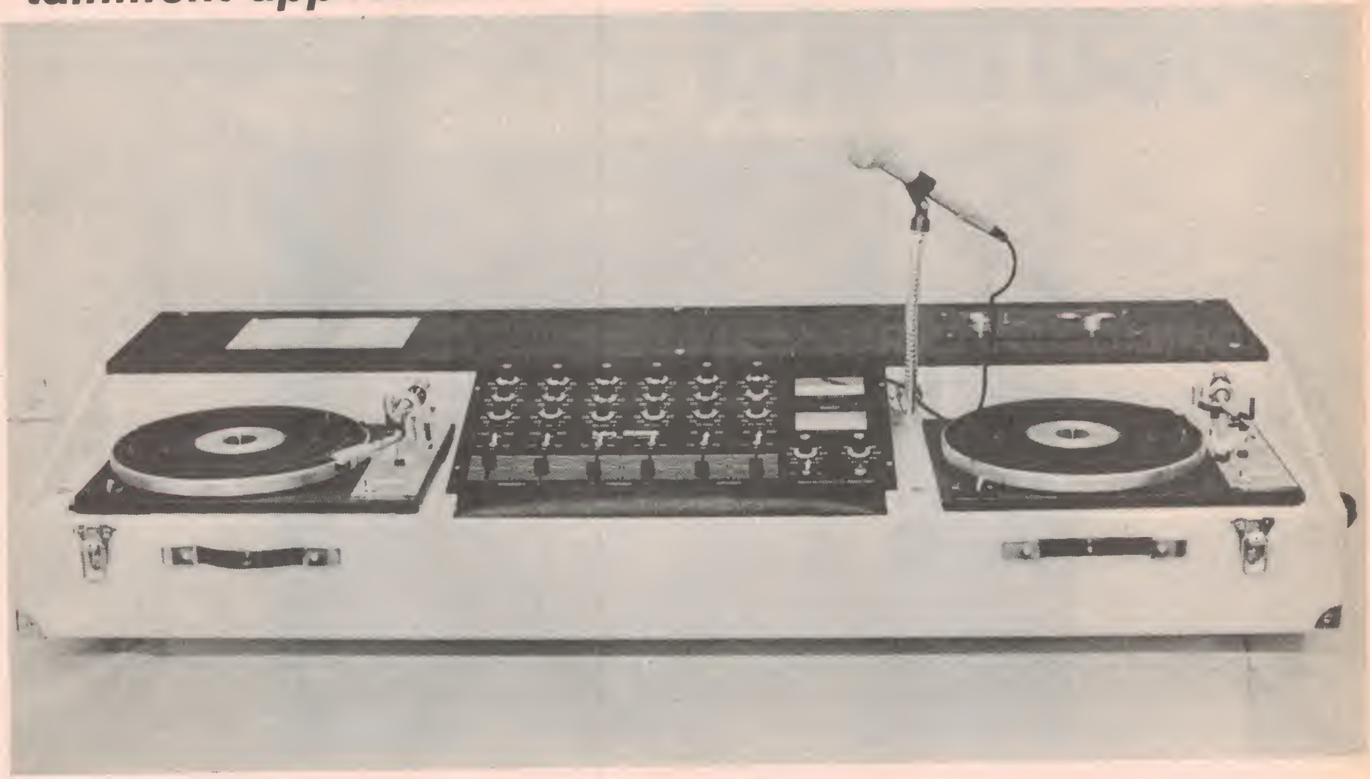
8.30 — 8.00 Thurs.

8.30 — 12.30 Sat.

KENT HI-FI PRESENTS
THE MOBILE ONE DISCO

suitable for discos, parties, clubs and many other entertainment applications.

$2200



Features: —

- Lighting control unit included
- Separate equalisation and balance controls on each input
- Attenuator pads on microphone and auxiliary inputs
- Stereo cue for each input
- VU and peak overload indicators on masters out
- More than ample level from headphone amp

Has all the functions of a professional studio mixer at a fraction of the cost. Speakers available to suit your requirements. For more information, please contact Kent Hi-Fi.

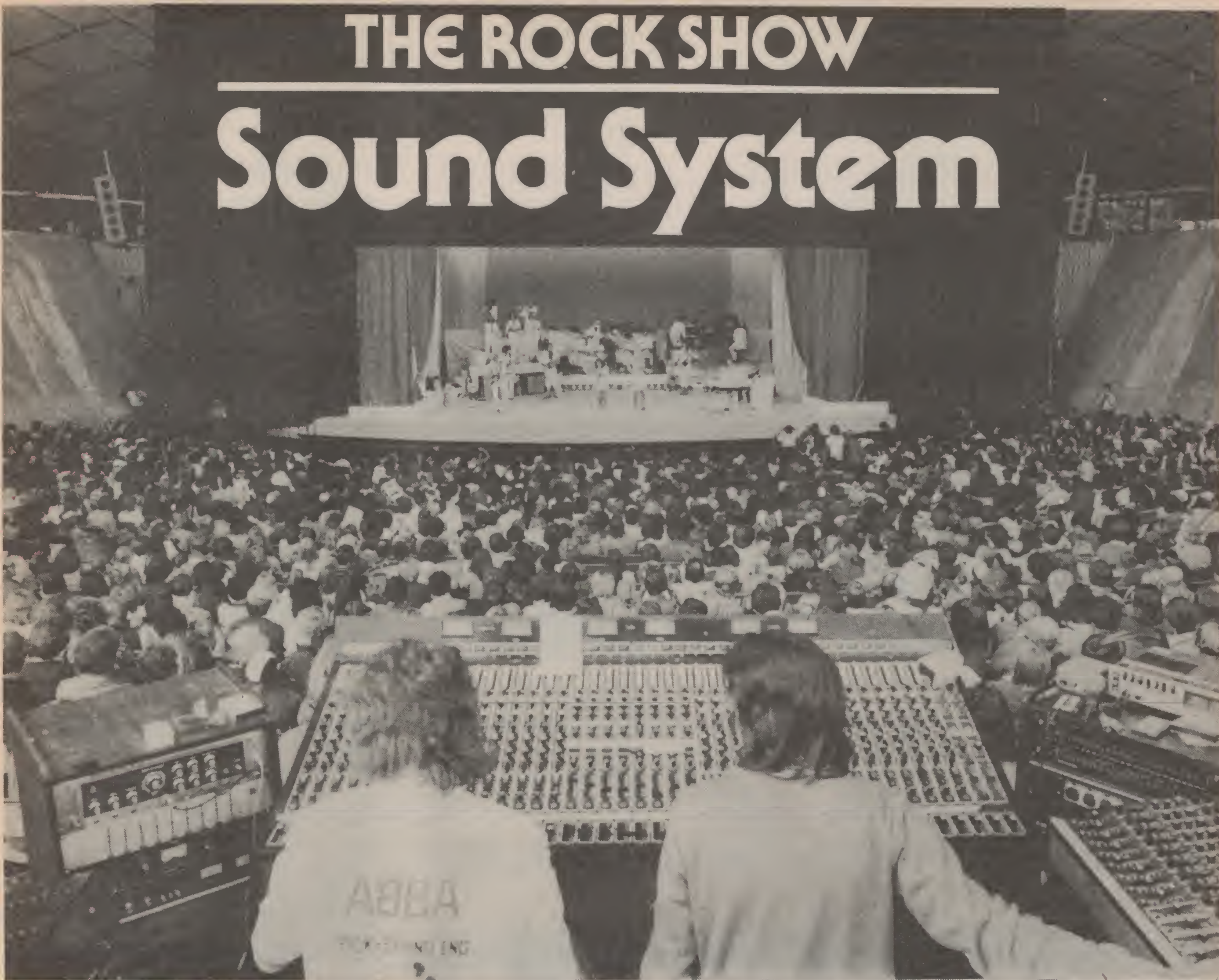
KENT HI-FI

(WHERE THE BEST EQUIPMENT COSTS LESS)

410 KENT STREET
SYDNEY
ph: 29-2743

THE ROCK SHOW

Sound System



The last couple of years have brought bigger and better equipment to the concert stage ... here Howard Page of Jands Pty describes the equipment used in presenting artists like Rod Stewart and Abba to Australian crowds exceeding 30,000.

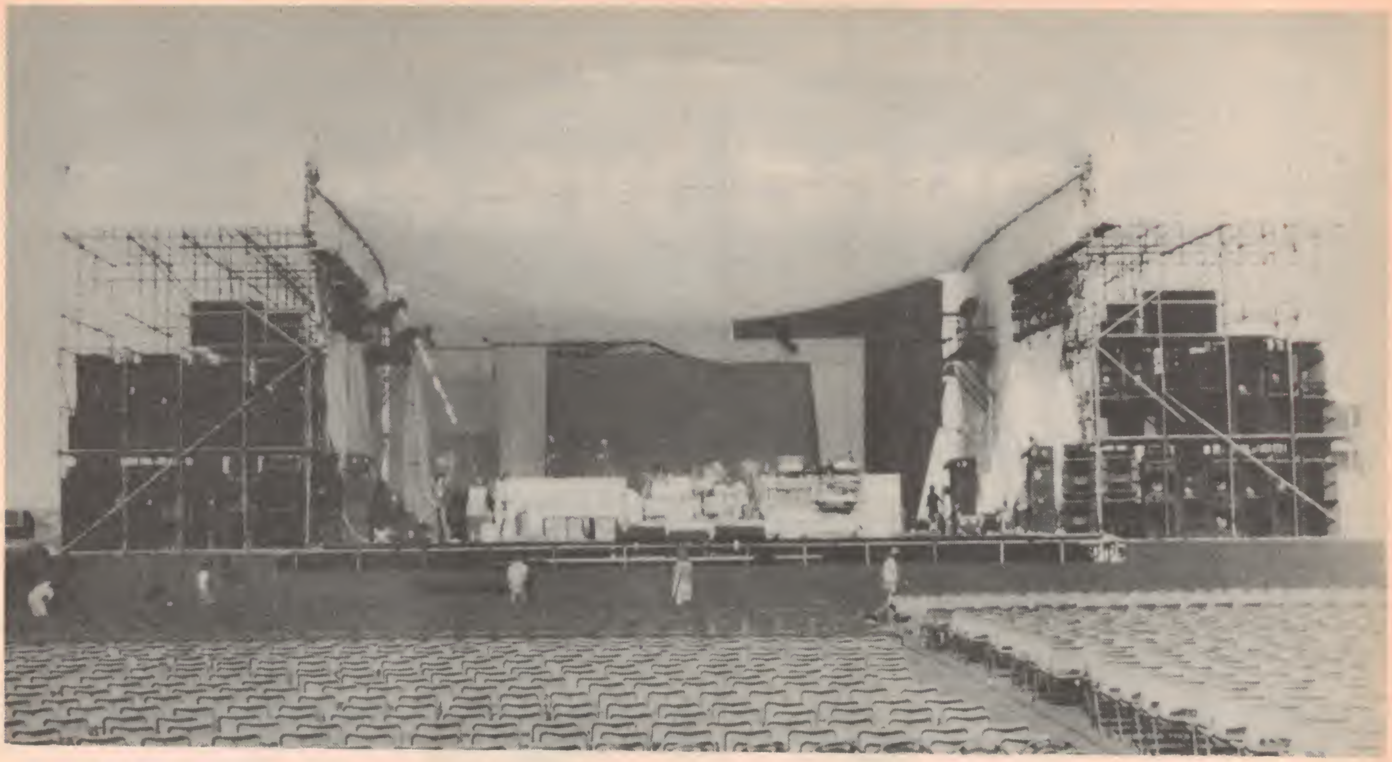
CONCERT SOUND SYSTEMS come in many sizes, shapes and forms and I don't think I've ever heard two systems that sound identical in the same hall. The sound engineers have different design philosophies although they share a common objective.

Expressions such as 4 way cross-overs, front loaded horns, radials, dispersion angles, etc, are banded about when the crews get together on tour but what **really** makes a good "state of the art" sound system? A system that, given the hundreds of variables such as hall acoustics, mood of audience, time available for set-up and tuning, road damage (that must be taken into account at every concert), will consistently deliver the best possible sound to the audience.

For some of the answers let's look at a system I designed for the Australian tours of Rod Stewart and Abba. The 'Jands No. 1 Touring System' weighs 28 tonnes and delivers a power output of 24,000 watts rms.

Let's follow the sound from its source looking first at microphones. The majority of these are made by Shure — type SM 58 for vocals and SM 57 for instruments. On the drums I use some other favorites such as Sennheiser MD 421 or AKG D12. The actual set-up depends on taste and the way the kit is tuned. The mics plug into 20-way multi-core cables leading to the mixer in the hall. The multi-core input box also has splitting outputs to feed any mic to the stage monitor mixer located on one side of the stage. The house mixing console is custom designed by myself and Jands consultant 'electronic genius' Phillip Storey. This is a 24 track in, 16 track out, studio style board made super-rugged for the 'road'. It has many facilities not normally needed on a PA mixer, such as the ability to do a stereo house mix, a **separate** stereo recording mix, a mono TV mix and an all-up 16 track output **all at one time**.

Why such extravagance? It is because in Australia (due to the limited audio facilities in TV OB vans) we often get asked if we can do all the above — for a live TV show with an album to be released later, so the extra features can be readily justified.

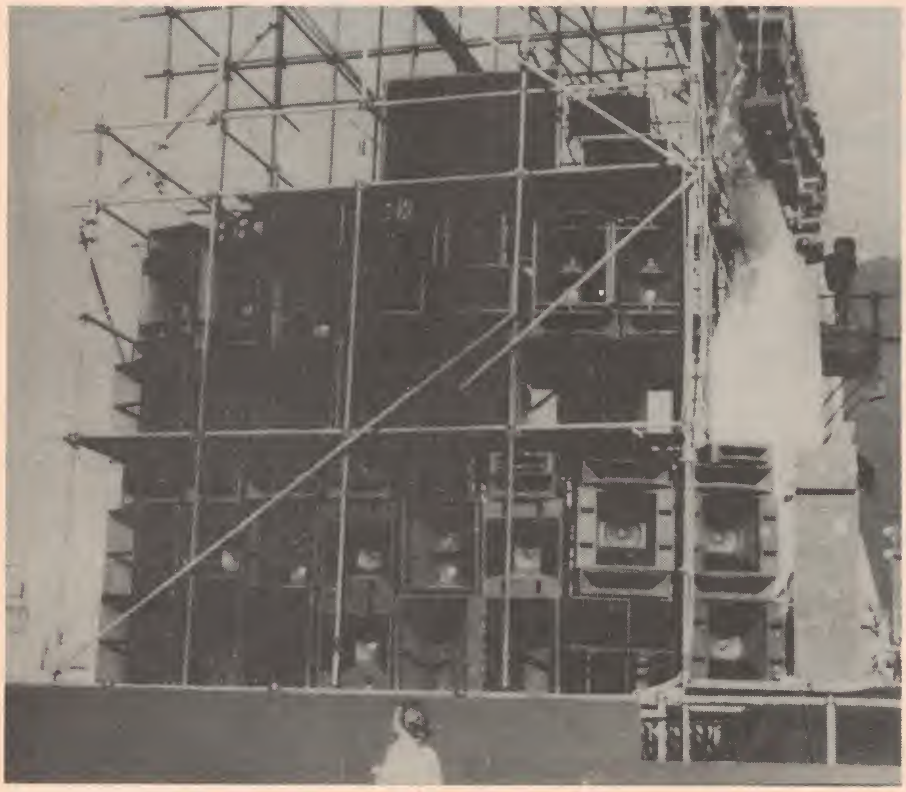


The stereo 'house mix' outputs of the board feed to a set of one-third-octave stereo graphic equalisers. These are set up using pink noise and real time analysis to accurately 'tune' the system for both the hall and, in some cases, the type of sound required. The stereo signals then feed a set of stereo DBX 160s (Compressor/Limiter) which are set as a final safeguard on the system to ensure the amplifiers are not driven into consistent square waves, one of the primary causes of speaker system failure.

Having been tuned and compressed as necessary the signals feed into a custom-built switchable 3, 4 or 5 way stereo electronic cross-over unit, the design of which is classified information. Also feeding in and out of the mixer are what we call FX devices, ie, echo unit, flanging units, extra compressors for various instruments, digital delay devices, etc, these are used as required.

Once the sound has been divided it is sent down a separate multi-core cable called a system feeder which plugs into the amplifiers on stage behind the speaker stacks. The amplifiers we use are the finest available 'state of the art' units: Phaser Linear 700B, Crown DC 300A, SAE 17K111CM, and a new unit we're especially proud of, our own Jands J600S which is proving equal, if not superior to, anything available from overseas.

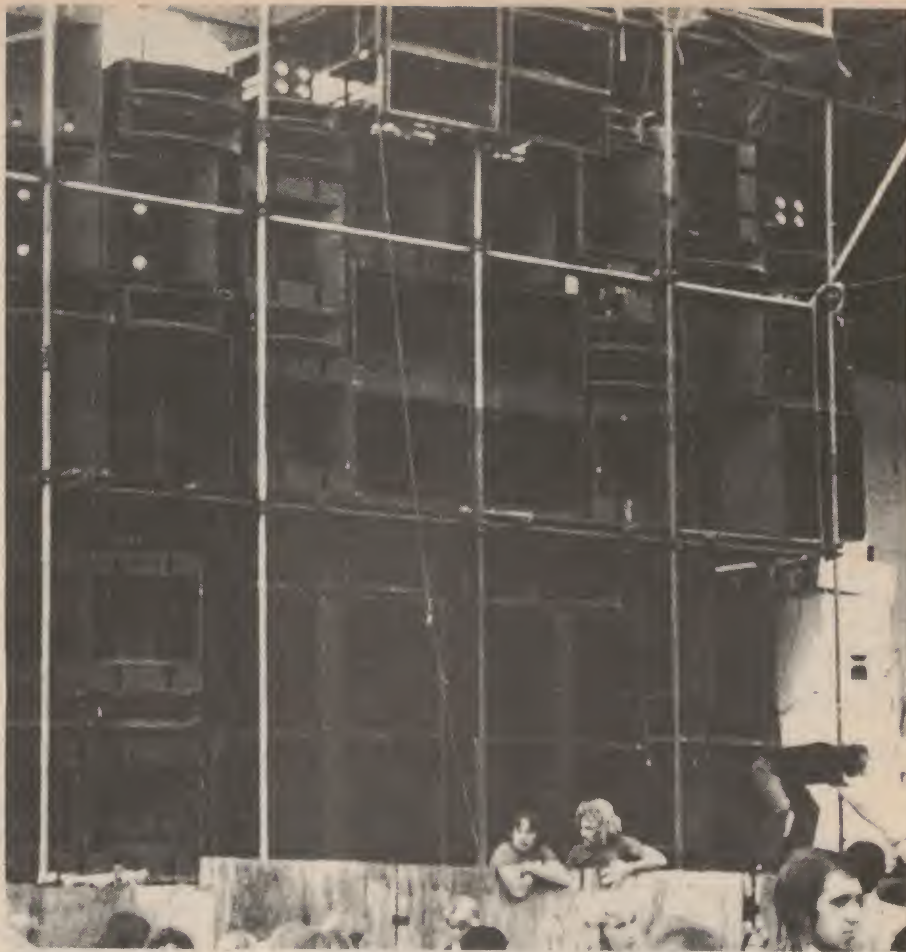
Each amplifier rack unit contains switching and matching systems to enable complete flexibility and access should a failure occur. Heavy duty speaker cables connect the amplifier outputs to the final link in the chain, the speaker units themselves. These, in the No 1 System, are for the 'Lo Boxes'



This is the tower of speakers used at one of the smaller gigs on the tour!

custom-designed Super 'W's containing 4 x 15" JBL (all components in the system are JBL) speakers; for the 'Hi Bass' or 'Mid Bass' another custom-designed front loaded 2 x 12" speaker box tuned reflex porting (for use as the bass unit in a 3-way system); for the 'Mids' JBL 90° and 60° Radial horn units with high powered compression drivers; and for the 'Highs' 2402, JBL 075 radiator units.

Well that's it, total cost approx. $250,000, but it represents where concert sound reinforcement is at now. Certainly a far cry from a column speaker on each side of stage but its worth it when I hear members of the audience muttering as they file out "They sound just like their record".



This set-up shows the speakers used at the Sydney showground for the Rod Stewart concert.

LIGHTING AND POWER

One of the biggest problems now facing Jands when operating a PA and lighting rig, such as that used on the Rod Stewart tour is to ensure adequate mains supply (240 V). Simple arithmetic gives power consumption: the PA has six amplifier racks per side, and each rack has 3 stereo amplifiers each drawing four amperes. Total consumption is $2 \times 6 \times 3 \times 4 = 144$ A. Stage equipment, including special effects, can easily draw 100 amperes. The lighting system comprises 100 lamps, each drawing 4 amperes. This adds another 400 amperes to the total requirement !

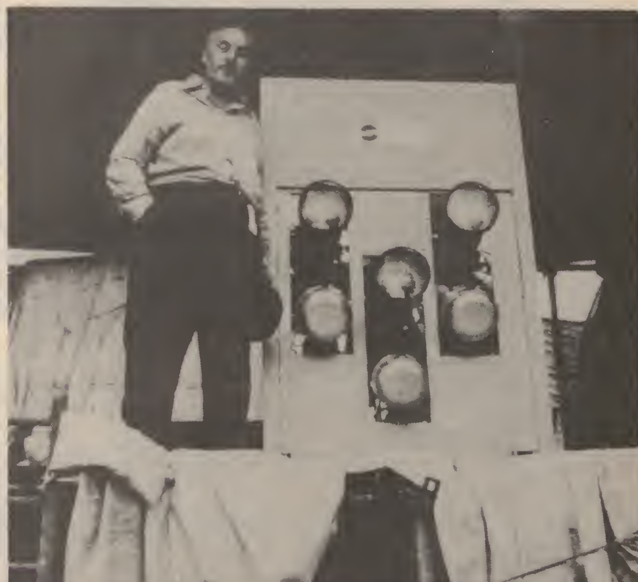
To help eliminate dimmer noise in the PA system using the three phase supplies, the lights are placed across two phases with sound and stage equipment across the third phase.

THE JANDS LIGHTING SYSTEM

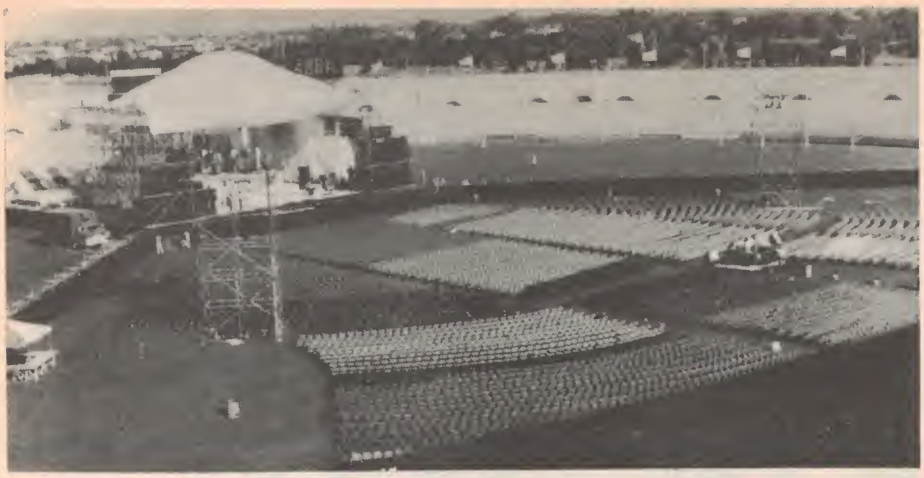
Control Desk:
There are forty eight channels each with two preset levels ('A' and 'B'), and a 'full' button. There are sixteen scene masters programable via a matrix patch board such that any of the 48 sliders can be put on any scene. A two-to-six way (selectable) chaser (a'sequencer') is available; any light can be placed on the chaser. The chaser has speed control, forward/reverse selection, intensity control and a chase/follow mode.

Dimmer Racks:
Rod Stewart used two racks, Each rack houses thirty-five 2 kW Strand Miniset cards packaged in plug-in modules. Jands have manufactured Miniset dimmers for Strand Electric since their introduction 6 years ago.

Lights:
The majority of the lights are manufactured by Jands Engineering according to an American design (they're called Altman Cans). They use 110 V 'Par 64' 1,000 watt lamps in pairs wired in series across the 240 supply. Connection to lamps is done with looms of 23/0076 3-core general-purpose flex.



George Mills brought this projection colour TV from London for the Sydney Rod Stewart concerts. Throughout the concert the audience has a close-up view of the action projected onto a massive screen.



The power supply Jands now insist on is 300 amperes per phase with a solid neutral. The electrical code permits a much lighter neutral than active in most installations, the assumption being the load can be expected to be balanced across the three phases and hence little neutral current flows back to the sub board. With the lights full up and no PA (as occurs at the end of each song) there is a great strain to pull the neutral towards the lighting phases and with a soggy neutral it is possible to get over 300 volts appearing on the PA phase (the neutral drifting 50 volts above earth).

Power is run from the sub-board to the dimmer racks and audio equipment via 416/0178 glass-insulated rubber sheathed mining trailing cable (cable rating 320 amperes and the copper core being 14 mm diameter). Each cable is fitted with a 350 ampere connector imported from Switzerland.

Each lighting phase runs direct into a dimmer rack housing thirtyfive 2 kW dimmer modules. The sound phase runs into a 19" electronics rack containing two 150 A breakers, one to feed PA the other the stage gear. Each breaker is connected to an earth leakage detector set to trip when more than 20 mA flows to earth. The current required to cause a fatal electric shock is 50 mA. Hence if any person comes in contact with a live wire on stage they cannot receive a fatal shock.

To avoid dimmer noise in the PA system it is often necessary to get a separate earth for the audio so Jands always carry a 6 foot solid copper earth stake and 10 kg of salt (for making a brine solution for better earth contact).

JANDS CONCERT SOUND SYSTEM AS USED BY ABBA/ROD STEWART TOURS OF AUSTRALIA

MONITORS

Mixer: Twenty input and six output buses. Each mic can be mixed onto one or all of the six buses, with or without tone control. This gives up to six separate monitor mixes so that each musician can have the extra foldback mix he requires . Each feed then passes through a graphic equalizer and into a Jands J600S to feed a foldback system.

Foldback Speaker System:

Each Side	1 x JBL 4550 with two JBL 2220.
	2 x JBL 4560 with one JBL 2220.
	2 x JBL 90° horns.
	1 x JBL 2390 horn lens.
Back Monitor	4 x JBL 4560 bass bins.
	2 x JBL 90° horns.
Front	4 x wedge monitor housing one JBL 15" bass and one JBL horn and driver.

MAIN SYSTEM

2 x 20-way multicore cables feed the signal from forty microphones to the front of house mixer. A Jands 24 channel in and 16 channel out mixer.

The custom-designed 24 track, 16 track out mixer has the following facilities on each module:

1. Selectable Input Attentuation
2. Channel Mute
3. Mic Phase Reverse
4. Mic/Line Switch
5. High Pass Filter (250 cycles 18 dB/octave)
6. Equalizer Bypass
7. Lo; Mid; High; 18 dB Boost/Cut at four selectable frequencies
8. Pan Pot
9. Eight Full Stereo Group Select Buttons
10. Solo Pre/Fade Listen Button

There are eight stereo sub groups with two other sets of eight for making separate mixes of the sub group for recordings, TV etc.

At the mixer are two 19" electronics racks.

The effects rack and the main system rack housing:
One third octave (27 band) stereo graphic DBX 160
2 x limiters DBX 160
2 x Jands 4-way crossover

The signal passes through each item then goes via a separate multicore to the stage to drive the amplifiers.

At each side of the stage are built the sound towers. These being 24' x 12' with three levels. Better dispersion is achieved by stacking high rather than wide. Each stack has the following:

8 x Amplifier Racks each containing 3 amplifiers these being Crown DC300A,Phase Linear 700B and Jands J600S.

The Speaker System:

12 x 4130 (Jands designed W Bins with four JBL 15" speakers in each).
4 x W cabinets containing two JBL 15" speakers.
24 x JBL 4560 Bass cabinets with one JBL 15" speaker.
16 x Double 12" cabinets (Jands design) containing two JBL 12" speakers.
20 x JBL 90° horns.
16 x JBL 60° horns.
8 x JBL long throw horns.
48 x JBL 075 high frequency.

The total JBL count on the Rod Stewart/Abba main system Sydney Concert was:
80 x 15" speakers.
32 x 12" speakers.
44 x Horns and drivers.
48 x High frequency.
Total value at your local hi-fi shop approx. $250,000.

The entire system is equalized before each concert using a pink noise generator and a Real Time Analyzer.

JVC

the right choice

How to turn this black and white page into a 28 page, full colour, JVC Hi Fi catalogue.

Write your name and address in the space below and send this page to us. To help you make the right choice, we'll send you our very lavish and very free hi fi catalogue by return.

Name__________________________

Address________________________

_____________Postcode__________

Address your envelope to:
JVC Advisory Service,
Hagemeyer (Australasia) B.V.,
P.O. Box 49,
Kensington.
N.S.W. 2033.

ETI

DENON

Professional audio brand

DL-109R

MOVING MAGNET CARTRIDGE

Output voltage: 3 mV (1 kHz 50 mm/sec)
Frequency response: 20 ~ 35,000 Hz

DL-103

MOVING COIL CARTRIDGE

Output voltage: 0.3 mV (1 kHz 50 mm/sec)
Frequency response: 20 ~ 45,000 Hz

AU-310

TRANSFORMER FOR MOVING COIL CARTRIDGE

Frequency response: 20 Hz ~ 40 kHz (±1 dB)
Load impedance: 50 kΩ or more

DL-109D

MOVING MAGNET CARTRIDGE

Output voltage: 3 mV (1 kHz 50 mm/sec)
Frequency response: 20 ~ 50,000 Hz

PCM RECORDS

(Pulse Code Modulation)

PIANO SONATAS

CONCERTOS

QUARTETS

and other classical music. More works now being released.

Call at any DENON stockist or contact

AWA

AMALGAMATED WIRELESS (AUSTRALASIA) LIMITED

554 Parramatta Road, Ashfield. N.S.W. 2131. Phone 797-5757

MELBOURNE	ADELAIDE	HOBART	CANBERRA	TOWNSVILLE	BRISBANE	PERTH	LAUNCESTON	NEWCASTLE
560 4533	272 2366	34 5266	95 3431	79 6155	44 1631	71 0888	44 5155	2 5166

AD A2

JANDS J600S Power Amplifier

We got our acoustical consultants, Louis A. Challis and Associates, to review one of the power amplifiers used in the rock show PA system described in the preceding article. This Australian-made amplifier can deliver 800 W into eight ohms.

ONLY THOSE PEOPLE WHO HAVE attended these shows would realise the fantastic acoustical levels that are used for the public performances of artists like Rod Stewart and Abba who have been near to the stage have witnessed the monumental amounts of equipment used for the public address, lighting and fold-back sound systems.

On the recent Rod Stewart tour the combined power level of the main amplifier system was 12,000 watts (electro-acoustic power) with a fold-back system power capability of 4,000 watts. It is intriguing that anybody could contemplate using a fold-back system of 4,000 watts power capability. It is even more intriguing that this is being monitored by real-time one-third octave band analysers so that the fold back mixing engineer can *continually* monitor the signal and spectral balance being fed to the musicians onstage.

With sound pressure levels in front of the musicians and in front of the stage as high as 120 decibels, and sound pressure levels at the rear of the audience area in excess of 90 decibels things seem to have gone a bit too far.

If one leaves the hearing conservation and community annoyance factors aside for the moment, we are considering acoustical powers and intensities which are bordering on dangerous. Today's systems would make the public address system designer of even a few years ago quake at the thought.

High Power Amplifier

Whilst high power amplifier have been around for quite a while, until recently these were, with few exceptions, the domain of the American designer. Recently the Japanese have released high powered amplifiers, most of which are very good, and to our surprise in the last few months one Australian manufacturer has offered a product in what is already a very competitive and technically advanced market.

We have previously reviewed the Phase Linear and the Crown amplifiers, amongst others, and found these products to be exceptionally good within the thermal limitations that all such amplifiers experience.

We were intrigued to be offered a Jands J600S Amplifier whose price must undoubtedly make it very competitive when compared to even the best of the overseas amplifiers. Having previously reviewed the Jands PS4 Amplifier two years ago, and having seen these installed in a number of discotheques and other high power installations, we were pleased to see this Australian manufacturer offering a power amplifier which offers a better *dollar per watt* performance in the high power amplifier big league. And we found that approximately one third of the amplifiers being used for both the Rod Stewart and Abba tours were Jands

MEASURED PERFORMANCE OF JANDS J600S STEREO POWER AMPLIFIER

Maximum Power Output: (Both Channels Driven)	220W 8Ω each channel 361W 4Ω each channel	
Frequency Response: (1 watt output)	5Hz to 75 kHz (–3dB) 14Hz to 32 kHz (–0.5dB)	
Total Harmonic Distortion:		
1 Watt:	100Hz	0.06%
	1kHz	0.06%
	6.3kHz	0.20%
200 Watts:	100Hz	0.068%
	1kHz	0.068%
	6.3kHz	0.083%
Hum & Noise: (I/P S/C)	0.6mV (Lin) –96dB (Lin) 0.088mV (A wtd) –113dB (A) 0.095mV (A wtd) –112dB (A)	
Input Sensitivity:	1.1 Volts for 200 Watts into 8Ω	
Slewing Rate:	Output 10V/μSec	

J600S, so we thought the time was right to find out why.

The J600S

The Jands J600S Power Amplifier came well packed in a solid cardboard carton with simple polystyrene corner supports. When we picked up the carton, we found out why the carton needed to be so solid, with a weight of 15kg because of its shape and weight distribution it almost requires two people to pick it up. On opening the carton we found a power amplifier designed for mounting in a 19" rack with dimensions of 478 mm x 132 mm x 335 mm deep. This corresponds to a standard 5¼" module spacing in a rack and is designed for the normal screw mountings.

The unit is basically a very large transformer mounted in a steel chassis with large black aluminium heat sinks on the back. We are told that the 19" racks used for the Rod Stewart tour buckled in transit to Adelaide but the amplifiers showed no signs of distress.

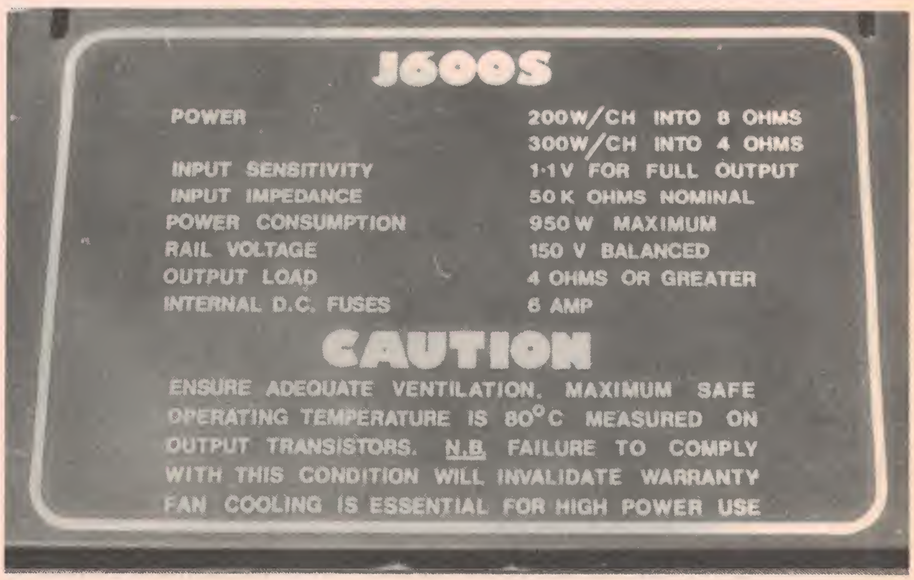
The first thing that caught our eye, apart from the black facade, was a label on the top of the Amplifier which said: "Caution. Ensure adequate ventilation. Maximum safe operating temperature is 80^{o} measured on the output transistor". The unit obviously requires copious quantities of cooling air to be able to attain its maximum power rating and label carefully points out that fan cooling is essential for continuous high power use. It must be acknowledged that this is true for all other comparable sized amplifiers on the market.

In picking up the amplifier we found that the edges of the amplifier handles were so sharp that they ripped one guy's trousers — this already put us on the wrong footing before reviewing the amplifier.

The next thing we noticed was that instead of the VU meters which are subject to abuse, and quite often premature failure, the J600S utilises two LED arrays with 3 dB increments to cover the range – 20 dB to 0 dB by use of switch control, the range –41 dB to –20 dB, for each channel. Apart from the two nasty handles, there are two channel level controls flanking the LED arrays, a power on/off switch and a –20 dB switch for altering the sensitivity of the LED display.

The front panel is a black 10 gauge aluminium panel with white screen printing, behind which the main steel chassis is fixed. We noted a slight bow in the front panel but this would partially correct itself when rack-mounted, due to the weight of the chassis pulling this tight against the panel system.

The transformer is massive and occupies more than a third of the chassis space available for the electronics. The remaining space is occupied by the power output stages located directly behind the double heat sinks, and the main electronic chassis. This consists of a printed circuit for the driving and pre-amplifier stages overlying the power supply filter circuitry (which consists of the main power rectifiers and two large electrolytic capacitors).



The top of the amplifier carries this specification plate.

The output transistors are mounted under four covers located at the bases of each pair of cooling fins.

The main circuit board is a full dip soldered board. This has been done to inhibit the nasty problems of premature corrosion in plain copper laminate circuit boards. All the driver stage transistors are fitted with individual heat sinks to enhance their thermal dissipation. All the components utilised are normal commercial grade with the exception of the power output stage transistors which are specially selected to provide the rated power capacity. The printed circuit boards utilised for power output stages are fully masked to inhibit corrosion and provide a long commercial life.

The Technicalities

One of the first questions which we asked on seeing this unit was, is it protected from thermal or current overload? The reasons for this were that some of the other amplifiers which we have reviewed have only fuses to protect the output transistors from abuse. The best amplifiers utilise very effective but complex electronic circuits to protect the output stage from short circuits and destructive current.

In the case of the PS4 Amplifier, Jands had sensibly provided a protection circuit which allowed one to pull sparks from the output stage (this often happens in the field when using high power amplifiers). Fortunately, the circuit designers have seen fit to include similar features in the J600S and we were able to happily draw sparks without blowing up the amplifier when applying short circuits. Obviously, with extended short circuits the fuses do blow, but this takes a few seconds.

The rear of the amplifier features two universal terminals for each output stage, a mains fuse, two RCA co-axial inputs and an array of four transistors mounted under clip-on covers on each of the four large heat sinks. The transistors utilised are RCA 2N3773s which have been individually matched by Jands in order to minimise distortion at high power levels. Before turning the unit on, we read the handbook which provides very little information, some of which is rather confusing. Whilst we must presume that this is a draft issue, we were surprised to see hand corrections, leaving us in doubt as to what are the manufacturer's final ratings for his amplifier. Whilst the handbook constitutes a good start, it does contain one worthwhile feature in that the back page comes with a complete factory test of all those major parameters which the intending purchaser would desire to have confirmed.

We submitted the amplifier to exhaustive tests which showed that, with few exceptions, the manufacturer's stated performance figures were equalled or exceeded, with the exceedance being primarily in the area of power capability into both 8 ohm and 4 ohm loads with both channels driven. We were gratified to find that the amplifier can deliver a healthy 800 watts at 1 kHz into an 8 ohm load. This, of course, is attractive for those people who need a high powered amplifier capable of providing an effectively flat frequency response from 20 Hz to 20 kHz.

The basic performance of the amplifier is very good, with the total harmonic distortion at 200 W being less than 0.1% under all operating conditions tested, and only tending to rise in the region above 10 kHz because of the type of output transistors utilised. This is one of the problems on the Australian market where at present there are very few high-powered high-frequency transistors available at a reasonable price. The hum and noise level was −96 dB linear and −112 dB (A) with respect to maximum power output with the gain controls at maximum setting.

The manufacturer quotes a slewing rate of 10 V per microsecond, which is particularly good, not that this is important unless the amplifier is to be used for high power-high frequency work (which is not the purpose for which it was intended). Even so this amplifier is capable of driving a shaker table, sonar transducers, servo systems and for a wide range of other military or industrial purposes.

The Final Test

We subjected the amplifier to imbalance signals with the input bridged, with one side of the output load earthed and found that we were able to induce an additional protective resistor (which is incorporated to prevent earth loop problems in multiple amplifier set-ups) to start cooking. At first we thought we had destroyed the amplifier, but on lifting up the covers we found that both the amplifier and the wire wound resistor were in no way impaired. We

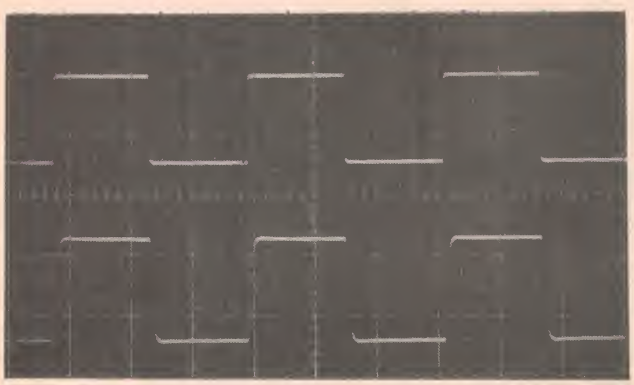
completed our testing without being able to blow up the amplifier although we must admit we tried!

Summary

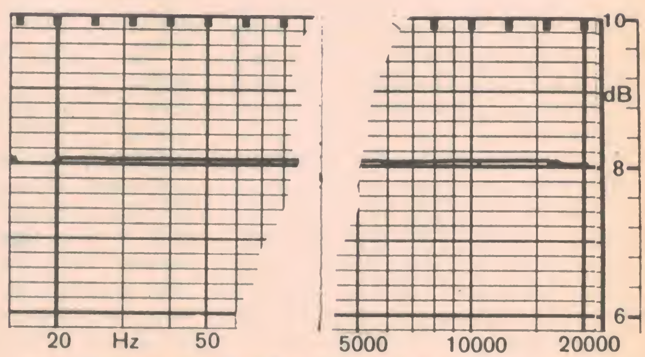
The J600S Power Amplifier is currently the best commercial high-power amplifier available on the Australian market in terms of dollars per watt and, provided the wage-price spiral does not continue, it should be readily able to compete effectively in some of the near eastern markets with the quality amplifiers currently available from America and Japan. Whilst its front finish is not as good as the imported units, its logical design features, greater ease of repair, and access to the electronics, must make it attractive for both the commercial user and the Hi-Fi fadist (or is that sadist?) who wants to run his own Rod Stewart or Abba shows at home. ●

Square Wave Response @ 100Hz into 8Ω @ 200W

Square Wave Response @ 1000Hz into 8Ω @ 200W



Square Wave Response @ 6.3kHz into 8Ω @ 200W



The frequency response graph was a dead straight line — here we show the two ends but the bit missing from the middle looks like it was drawn with a ruler.

LOGITECH LC—40D

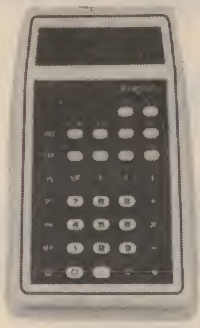
$35.00

TAX EXEMPTED

(including Adaptor & rechargeable batteries) plus 15% Sales Tax if applicable.

- 37 Function keys (8 with double function)
- Bright green display
- 8-digit mantissa with sign and 2-digit exponent with sign
- Number entry in either floating point or scientific notation
- Scientific notation with 200 decade range (10^{-99} to 10^{99})
- Two levels of parenthesis
- One accumulating memory with overflow protection
- Algebraic operation
- Constant and repeat operations
- Most functions usually found in advanced calculators, including:
  - polar ↔ rectangular coordinate conversions
  - decimal degree ↔ degree, minute, second conversions
  - sin, cos, tan, $\sin^{-1}$, $\cos^{-1}$, $\tan^{-1}$, 10^x, e^x, ln, log, x^y, 1/x, $\sqrt{x}$, and x^2.
  - Trigonometric functions with arguments in degrees, radians or grads

12 months guarantee



LOGITECH LC—1233s

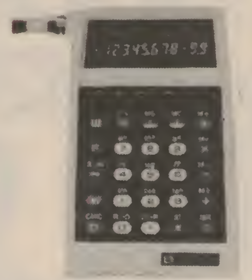
$27.00

TAX EXEMPTED

$11.00 for Adaptor & rechargeable batteries plus 15% Sales Tax if applicable

- Large green display - 10 digit 8 mantissa and 2 digit exponent
- Two levels of parenthesis
- Floating decimal point or scientific notation
- Range -1×10^{-99} to $1\times10^{+99}$
- Trig. functions: sin, cos, tan, $\sin^{-1}$, $\cos^{-1}$, $\tan^{-1}$
- Degree or radian mode
- Degree to radian and radian to degree conversion
- Logarithmic functions: log, ln, anti log, anti ln
- Power functions: e^x, 10^x, a^x
- Factorial functions: x! (for $x < 70$)
- Square root & reciprocal
- Algebraic mode operation
- Chain & repeat operation
- Full arithmetic or memory calculation: M+, M−, Mx, M÷

12 months guarantee



LOGITECH LC—831s

$18.00

TAX EXEMPTED

$11.00 for Adaptor & rechargeable batteries plus 15% Sales Tax if applicable.

- Green 8-digit display
- One memory
- Four arithmetic functions: (+ − x ÷)
- Algebraic mode operation
- Fully floating decimal point
- Chain & repeat operation
- Constant operation
- Leading zero suppression
- X & Y register exchange
- X & Y memory register exchange
- Square root & reciprocal
- Trigonometric functions: sin, cos, tan, $\sin^{-1}$, $\cos^{-1}$, $\tan^{-1}$
- Logarithmic functions: log, ln
- Power functions: e^x, x^y
- Degree or radian mode

3 months guarantee

ZENY—35SR

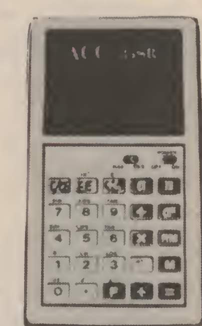
$19.00

TAX EXEMPTED

$9.00 for Adaptor & rechargeable batteries plus 15% Sales Tax if applicable

- Display: green, signed 8-digit floating point or signed 5-digit mantissa with signed 2-digit exponent
- Number entry in either floating point or scientific notation
- Scientific notation with 200 decade range (100^{-99} to 10^{99})
- Two levels of parenthesis, except for certain scientific functions for which only one level is available
- One independent memory
- Scientific functions: sin, cos, tan, $\sin^{-1}$, $\cos^{-1}$, $\tan^{-1}$, e^x, 10^x, ln, log, x^y 1/X, x, and x^2
- Degree or radian mode switch for trigonometric functions

3 months guarantee



LC-10D	32.00	TAX EXEMPTED
SR-46	28.00	
SR-40	27.00	
Adaptor only	5.00	
Nicad battery	1.50	

ZENY—34M

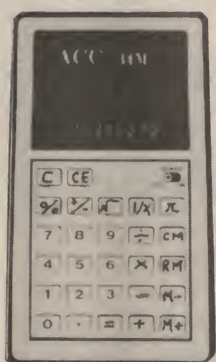
- Green 8-digit display
- Four arithmetic functions
- Square root & reciprocal
- One accumulating memory
- Constant and chain calculations
- Automatic percentage calculations
- π
- Algebraic mode operation
- Leading zero suppression

3 months guarantee

$11.00

TAX EXEMPTED

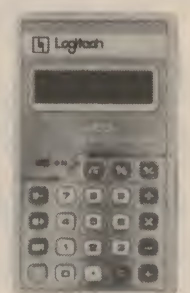
$9.00 for Adaptor & rechargeable batteries plus 15% Sales Tax if applicable



LOGITECH LC—20U

- 8-digit liquid crystal display
- 6-function plus memory accumulation
- Low power consumption (0.003 use one 1.5V AA battery lasting 250 Hr)
- Soft and sensible key touching
- Operating in algebraic mode
- 113mm x 63.5mm x 13.5-17.5mm max.

3 months guarantee



$17.00

TAX EXEMPTED

plus 15% Sales Tax if applicable

SALES TAX (EXEMPTIONS AND CLASSIFICATIONS) ACT

TO: — THE COMMISIONER OF TAXATION AND THE COMMONWEALTH OF AUSTRALIA

I hereby certify that the (Goods Description)
purchased by me from (Supplier)
on (date) is for use in

(Name of University or School) in or directly and essentially in connection with, the production of facts, by means of observing, measuring, testing or otherwise experimenting with material phenomena, for the purpose of proving or illustrating natural principles or laws or in the study of pure or mixed mathematics. Exemption is accordingly claimed under item 63 (1) in the First Schedule to the Sales Tax (Exemptions and Classifications) Act.

Signature of official of University or School ....

Designation ....

Name of University or School ....

Date.......................... Signature of Student ....

Address of Student ....

....

CHAN MERCHANDISING CO. PTY. LTD.
P.O. Box 705 Darlinghurst N.S.W. 2010

111 RESERVOIR STREET, SURRY HILLS. SYDNEY
TEL: (02) 211-4660

906 CASSON AVENUE, MOUNT HUTTON, N.S.W., 2290

TELEPHONE: NEWCASTLE (049) 48 9676

I have enclosed cheque/money order for $........................ including $2.00 for packaging and delivery.

Name..
(Block Letters)

Address..

....

....(Postcode) ....

555 TIMER APPLICATIONS

DESCRIBED BY R. M. MARSTON PART I

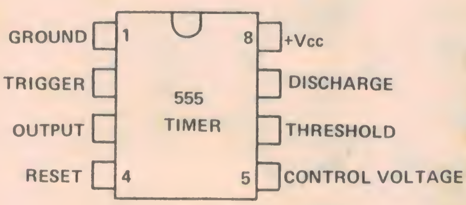


Fig. 1. Outline and pin notations of the standard 8-pin DIL version of the 555 timer I.C.

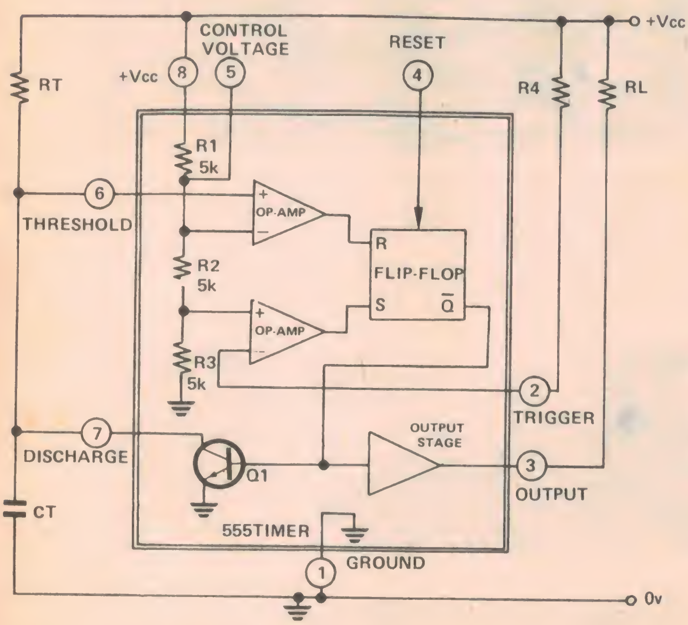


Fig. 2. Functional block diagram (within the square) of the 555 timer i.c., together with the connections for using the i.c. as a basic monostable generator or timer.

THE 555 TIMER is a highly versatile low-cost IC specifically designed for precision timing applications. It can also be used in monostable multi-vibrator, astable multivibrator, and Schmitt trigger applications. The device was originally introduced by Signetics, but is now available from many other manufacturers.

The 555 has many attractive features. It can operate from 4.5v to 16v. Its output can source (supply) or sink (absorb) any load current up to a maximum of 200 mA, and so can directly drive loads such as relays, LED's, low-power lamps, and high impedance speakers. When used in the 'timing' mode, the IC can readily produce accurate timing periods variable from a few microseconds to several hundred seconds via a single R-C network. Timing periods are virtually independent of supply rail voltage, have a temperature coefficient of only .005% per^{o}C, can be started via a TRIGGER command signal, and can be aborted by a RESET command signal.

When used in the monostable mode, the IC produces output pulses with typical rise and fall times of a mere 100 nS. It can be made to produce pulse-width modulated (PWM) pulses in this mode by feeding fixed frequency clock pulses to the TRIGGER terminal and, by feeding the modulation signal to the CONTROL VOLTAGE terminal.

When used in the astable mode both the frequency and the duty cycle of the waveform can be accurately controlled with two external resistors and one capacitor. The output signals can be subjected to frequency sweep control, frequency modulation (FM), or pulse-position modulation (PPM) by applying suitable modulation signals to the CONTROL VOLTAGE terminal of the IC.

HOW IT WORKS

The 555 is available under a variety of specific type numbers but is generally referred to simply as a '555 timer.' The device is available in a number of packaging styles, including 8 and 14-pin dual-in-line (DIL) and 8-pin TO-99 types. Throughout this article all circuits are designed around the standard 8-pin DIL versions of the device.

Figure 1 shows the outline and pin notations of the standard 8-pin DIL version of the 555, and Fig 2 shows the functional block diagram of the same device (within the *double* lines), together with the connections for using it as a basic monostable generator. The following explanation of device operat-

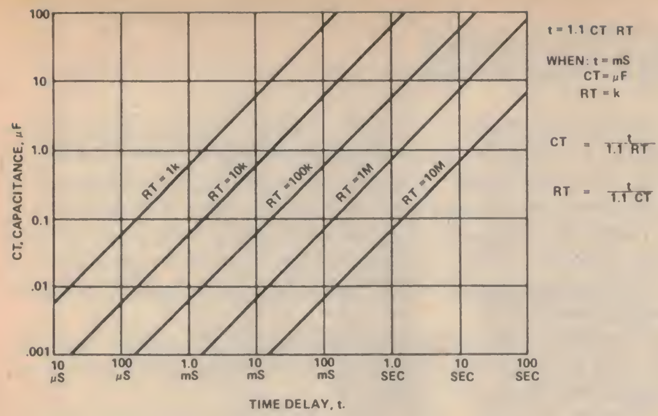


Fig. 3. 555 time delays for different values of resistance and capacitance.

ion assumes that the 555 is used in the monostable configuration shown in Figure 2.

The 555 houses two diodes, 15 resistors, and 23 transistors. These components are arranged one voltage-reference potential divider, two voltage, comparator op-amps, one R-S flip-flop, a low-power complementary output stage, and a slave transistor. The voltage-reference potential divider comprises three 5 kΩ resistors in series, and is connected across the supply lines. Consequently, 2/3 Vcc appears at the junction of the upper two resistors of the potential divider, and is fed to one input terminal of the upper voltage-comparator op-amp and 1/3 Vcc appears at the junction of the two lower resistors of the potential divider, and is fed to one input terminal of the lower voltage-comparator op-amp. The outputs of the two comparators control the R-S flip-flop, which in turn controls the states of the complementary output stage and the slave transistor. The state of the flip-flop can also be influenced by signals applied to the pin 4 RESET terminal.

When the monostable or timing circuit of Fig 2 is in its quiescent state, the pin 2 TRIGGER terminal of the chip is held high via R1. Q1 is driven to saturation and forms a short circuit across external timing capacitor CT, and the pin 3 output terminal of the IC is driven to the low state. The monostable action can be unitiated by applying a negative-going trigger pulse to pin 2. As this pulse falls below the 1/3 Vcc, reference value of the built-in potential divider the output of the lower voltage comparator op-amp changes state and causes the R-S flip-flop to switch over. As the flip-flop switches over it cuts off Q1 and drives the pin 3 output of the chip to the high state.

As Q1 cuts off it removes the short from timing capacitor CT, so CT starts to charge exponentially towards the supply rail voltage until eventually the voltage across CT reaches 2/3 Vcc. At this point the upper voltage comparator op-amp changes state and switches the R-S flip-flop back ot its original condition, so Q1 turns on, rapidly discharging CT, and simultaneously the pin 3 output of the IC reverts to its low state. The monostable operating sequence is then complete. Note that, once triggered, the circuit cannot respond to additional triggering until the timing sequence is complete, but that the sequence can be aborted at any time by feeding a nagative-going pulse to pin 4.

The delay time of the circuit, in which the pin 3 output is high, is given as

$$t = 1.1 \text{ R} \quad \text{C}$$

where t = mS, RT = kΩ, and CT = μF. Figure 3 shows how delays from 10μS to 100 seconds can be obtained by selecting suitable values of CT abd RT in the range .001μF to 100 μF and 1 kΩ to 10 MΩ or greater than 20 MΩ, and capacitor CT must always be a low-leakage component. Note that the timing period of the circuit is virually independent of the supply voltage but that the period can be varied by applying a variable resistance or voltage between the ground and pin 5 CONTROL VOLTAGE terminals of the chip. This facility enables the periods to be externally modulated or compensated.

The pin 3 output terminal of the IC is normally low, but switches high during the active monostable sequence. The output can either source or sink currents up to a maximum of 200 mA, so external loads can be connected between pin 3 and either the positive supply rail or the ground rail, depending on the type of load operation that is required. The output switching rise and fall times are typically about 100 nanoceconds. Having cleared up these points, let's now go on and look at some practical applications of the 555 timer I.C.

50 SECOND TIMER

This 50 second timer or pulse generator gives a direct voltage output at pin 3 which is normally low, but goes high for the duration of the timing period. Opticnal components R4 and LED (shown dotted) give a visual indication of the timer action. The circuit works in the same basic way as already described, except that the timing action is initiated by momentarily shorting pin 2 to ground via START switch S1 Note from the circuit waveforms that a fixed-period output pulse is available at pin 3 and an exponential sawtooth with an identical period is available at pin 7: The sawtooth waveform has a high output impedance.

The basic timer circuit of Fig 4 can be varied in a number of ways. The timing period can be made variable between approximately 1 . 1 seconds and 110 seconds by replacing

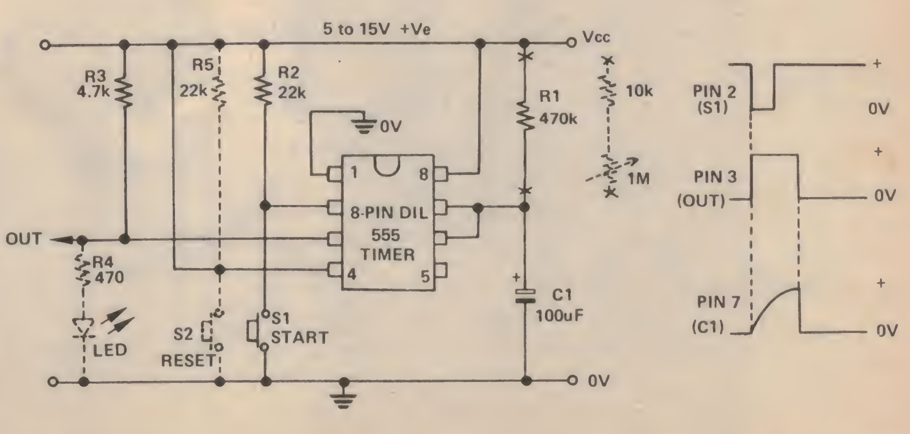


Fig. 4. Circuit and waveforms of simple manually-triggered 50 second timer or pulse generator.

555 TIMER APPLICATIONS

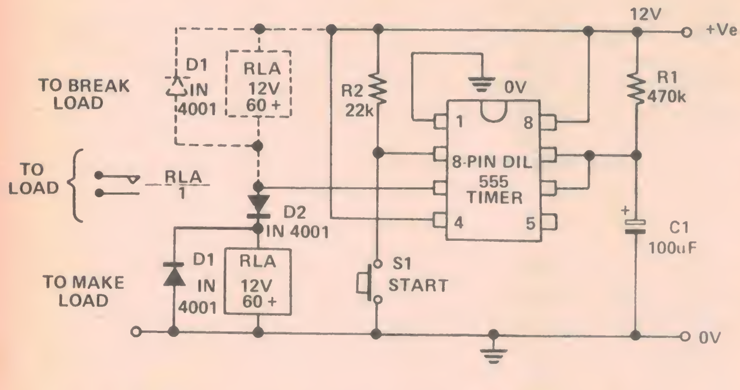


Fig. 5. Relay-output timer makes or breaks connection to load for pre-set period of 50 seconds when S, is momentarily operated.

R1 with a 10 kΩ fixed resistor and a 1 MΩ variable resistor in series.

The period can be further varied, if required, by switch-selecting decade values of timing capacitance. The dotted section shows how the circuit can be provided with a RESET facility, so that a timing period can be aborted at any time, by taking pin 4 to the positive supply rail via resistor R5 and wiring RESET switch S2 between pin 4 and ground.

The timing circuit of Fig 4 can be used to drive non-inductive loads at currents up to 200 mA directly. They can be used to drive inductive relay loads by using the basic connections shown in Fig 5.

The (Fig 5) circuit is designed to apply a connection to a normally-off external load for a pre-set period of 50 seconds when START switch S1 is momentarily closed. The relay is normally off, but turns on for the 50 second period when the timing cycle is initiated. D2 is wired in series with the relay coil to counteract the slight residual voltage that appears at pin 3 of the IC under the OFF condition and thus ensure that the relay turns fully off. The dotted section shows how this circuit can be used to switch off a normally-on load.

Note in Fig 5 and all other relay-output circuits described here, that the relays used can be any 12 volt types that draw ON currents of less than 200 mA, e.g., that have coil resistances greater than 60 Ω.

The basic relay-driving timer circuit of Fig 5 can be adapted for use in a variety of useful applications. Some typical examples are shown in Figs 6 to 9.

Figure 6 shows the practical circuit of a relay-output general-purpose timer that covers 0.9 seconds to 100 seconds in two decade ranges. The circuit has a RESET facility provided via S2 , so thattiming periods can be aborted part way through a cycle if necessary. A noteworthy feature of this circuit is that the maximum timing periods of each decade range of the timer can be precisely pre-set via R5 or R6 , which effectively shunt the built-in potential divider of the 555 and thus influence the timing periods: This facility enables the circuit to give precise timing periods even when wide-tolerance timing capacitors are used.

To set up the Fig 6 circuit, first set R1 to maximum value, set RANGE switch S3 to position 1, activate START switch S1, and adjust R5 to give a timing period of precisely 10 seconds. Next, set S3 to position 2, activate START switch S1, and adjust R6 to give a timing period of precisely 100 seconds. All adjustments are then complete, and the timer is ready for use.

DELAYED HEADLIGHT TURN-OFF

Figure 7 shows the practical circuit of an automatic delayed-turn-off headlight control system for auto-mobiles. This facility enables the owner to use the car lights to illuminate his path for a pre-set time after parking as he leaves the garage or walks along a driveway, etc. The circuit does not interfere with normal headlight operation under actual driving conditions. It works as follows.

When the ignition switch is turned to the ON position current is fed to the coil of the relay via D3 and the 12 volt supply rail, so the relay turns on and contacts RLA/1 close. As the contacts close they connect the 12 volt supply rail, so the relay turns on and the headlight switch. Thus, under this 'ignition on' condition the headlights operate in the normal way. Note that, since one side of C2 is connected

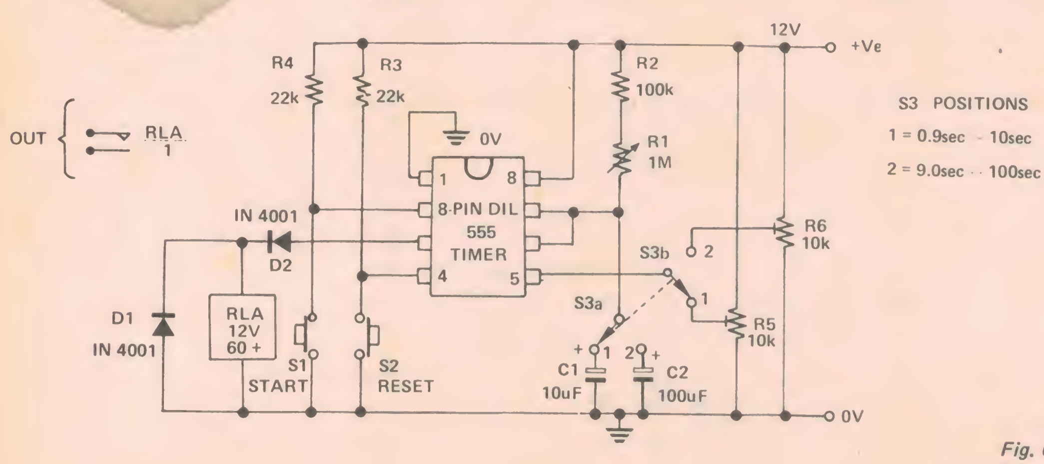


Fig. 6. Relay-output general-purpose timer covers 0.9 sec to 100 sec in two decade

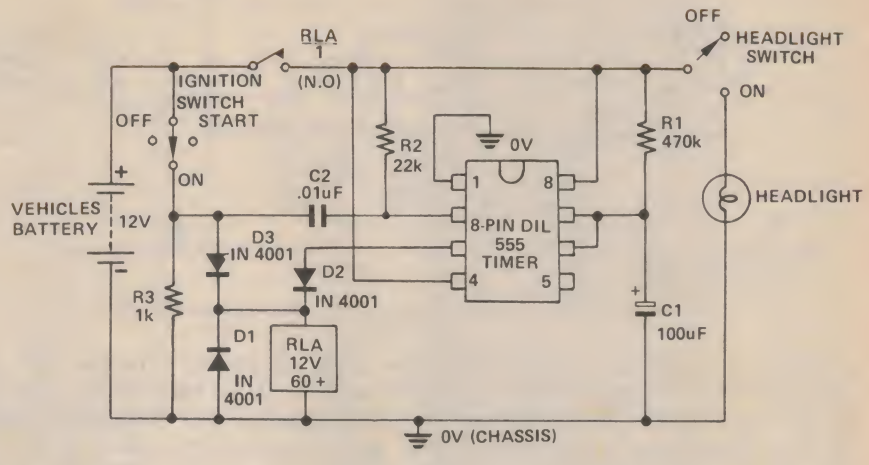


Fig. 7. Automatic delayed-turn-out headlight control system for automobiles.

directly to the positive supply rail and the other side is taken to the positive rail via R2, the capacitor is fully discharged under this condition.

The moment that the iginition switch is turned to the OFF position the D3-derived current supply to the relay coil is broken, and simultaneously a negative-going trigger pulse is fed to pin 2 of the 555 as the C2-R3 junction drops to ground volts and C2 charges up. Relays are inherently slow-acting devices, so contacts RLA/1 do not open instantaneously as the ignition switch is turned off. Conversely, the 555 is a very fast triggering device, and the instant that the trigger pulse is generated, via the turn-off action of the ignition switch a timing cycle is initiated and current is fed to the relay coil via output pin 3 of the IC as it goes high. Thus the relay remains on for a pre-set period after the ignition connected to the headlight switch for the duration of this period. With the component values shown this period is roughly 50 seconds.

At the end of the 50 second timing period, pin, 3 of the 555 switches to the low state and the relay turns off. As it does so, contacts RLA/1 open and remove the supply from the timer and the headlight switch, and the headlights turn off. The operating sequence is then complete.

Readers may care to note that the above system of operation is consistent with the practice adopted in many modern vehicles of feeding the headlight switch via the ignition switch, so that the headlights operate only when the ignition is turned on. On older types of vehicle, where headlight operation is independent of the ignition switch, a manually-triggered delayed-turn-off headlight or spotlight control facility can be obtained by using the circuit shown in Fig 8. The action of this circuit is such that, if the vehicle is parked with its lights off, they turn on for a pre-set 50 second momentarily closed, and at the end of this period turn off again automatically.

The (Fig 8) circuit uses a relay with two sets of normally-open relay contacts. The timing sequence is initiated by momentarily closing push-button switch S1. Normally, both S1 and the relay contacts are open, so zero power is fed to the timer circuit and the lights are off. C2 discharged under this condition.

When S1 is momentarily closed power is fed directly to the relay coil, and the relay turns on. As the relay turns on, contacts RLA/2 close and apply power to the vehicle lights and contacts RLA/1 close and apply power to the timer circuit, but pin 2 of the IC is briefly tied to ground via C2 and R3 at this moment, so a negative trigger pulse is immediately fed to pin 2 and a timing cycle is initiated. Consequently, pin 3 of the 555 switches high at the moment that the relay contacts close, and thus locks the relay into the ON

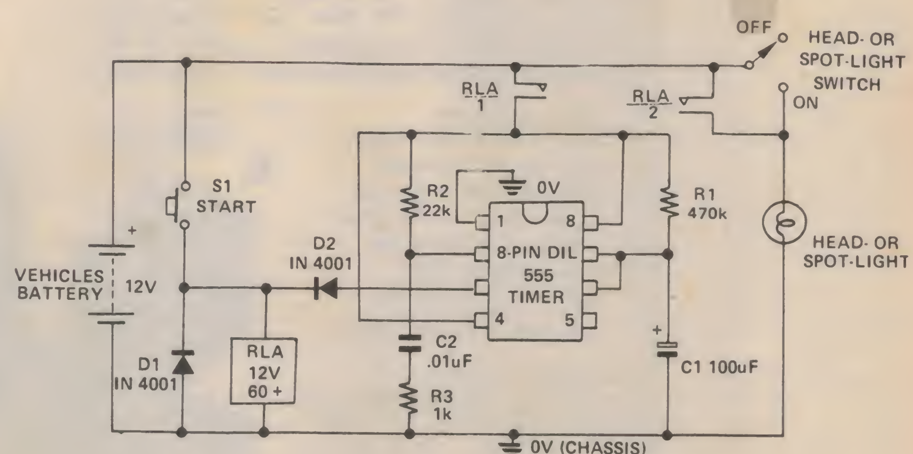


Fig. 8. Manually-triggered delayed-turn-off head- or spot-light control system for automobiles.

555 TIMER APPLICATIONS

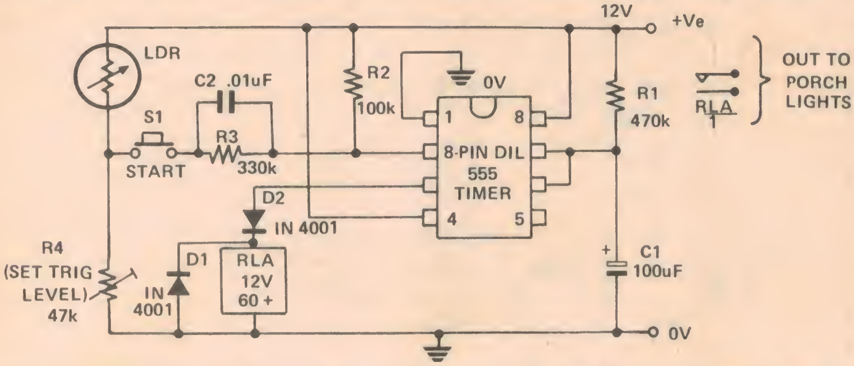


Fig. 9. Automatic porch light turns on for a pre-set period only when triggered at night.

condition irrespective of the subsequent state of START switch S1 so the lights remain on for the duration of the 50 second timing cycle. At the end of the timing cycle pin 3 of the IC switches to the low state, so the relay turns off and contacts RLA/1 and RLA/2 open, disconnecting power from the timing circuit and the lights. The operating sequence is then complete.

PORCH LIGHT

Finally, to conclude this 'Timer Circuits' section of the 555 story, Fig 9 shows the circuit of a relay-output automatic porch light control unit that turns the porch lights on for a pre-set 50 second period only when suitably triggered at night time or under 'dark' conditions: The circuit is triggered via switch S1, which may take the form of a microswitch activated by a porch gate or a pressure-pad switch activated by body weight and concealed under a porch mat or rug.

The operation of the Fig 9 circuit relies on the fact that for correct timer operation the negative-going trigger pulse that is fed to pin 2 of the IC must fall below the internally-controlled '1/3 Vcc' voltage value of the 555. If the trigger pulse does not fall below this value, timing cycles can not be initiated by the trigger signal.

In this design, light-dependent resistor LDR and preset resistor R4 are wired in series as a light-dependent potential divider. One side of switch S1 is taken to the output of this postential divider, and the other side of the switch is taken to pin 2 of the IC via the C2-R3 combination. Under bright or daylight conditions the LDR acts as a low resistance, so a high voltage appears at the output of the potential divider. Consequently, the act of closing S1 causes a voltage pulse much higher than '1/3 Vcc' to be fed to pin 2 of the chip, so the timer is not triggered via S1 under the 'daylight' condition.

Conversely, the LDR acts as a high resistance under dark or 'night' conditions, so a low voltage appears at the output of the potential divider. Consequently, the act of closing S1 causes a voltage pulse much lower than '1/3 Vcc' to be fed to pin 2 of the IC, so the time circuit is triggered via S1 under the 'night' condition.

In practice, the LDR can be any cadmium-sulphide photocell that presents a resistance in the range 1 kΩ to 100 kΩ under the required minimum 'dark' turn-on condition, and R4 can be adjusted to preset the minimum 'dark' level at which the circuit will trigger. Note that the trigger signal is fed to pin 2 of the IC via the C2-R3 combination, which act as a trigger signal conditioning network that effectively isolates the d.c. component of the LDR-R4 potential divider from the trigger pin of the IC.

To be continued

KITS FOR ETI PROJECTS

We get many enquiries from readers wanting to know where they can get kits for the projects we publish. The list below indicates the suppliers we know about and the kits they do.

Any companies who want to be included in this list should phone Steve Braidwood on 33-4282.

Key to companies:

- **A** Applied Technology Pty. Ltd. of Hornsby, NSW.
- **C** Amateur Communications Advancements, PO Box 57, Rozelle, NSW.
- **D** Dick Smith Pty. Ltd. of Crows Nest, NSW.
- **E** E.D. & E. Sales, Victoria.
- **J** Jaycar Pty. Ltd. of Haymarket, NSW.
- **L** Delsound Pty. Queensland.
- **N** Nebula Electronics Pty. Ltd. of Rushcutters Bay, NSW.
- **O** Appollo Video Games of Hornsby, NSW.
- **P** Pre-Pak Electronics of Croydon, NSW.

PROJECT ELECTRONICS

ETI 043	Heads or Tails	A
ETI 044	Two-Tone Doorbell	A
ETI 061	Simple Amplifier	A
ETI 064	Intercom	A
ETI 066	Temperature Alarm	A
ETI 068	LED Dice	A

TEST EQUIPMENT

ETI 101	Logic Power Supply	E
ETI 102	Audio Signal Generator	E,D
ETI 103	Logic Probe	E
ETI 107	Widerange Voltmeter	E
ETI 108	Decade Resistance Box	E
ETI 109	Digital Frequency Meter	E
ETI 111	IC Power Supply	E
ETI 112	Audio Attenuator	E
ETI 113	7-Input Thermocouple Meter	P,E
ETI 116	Impedance Meter	E
ETI 117	Digital Voltmeter	E,A
ETI 118	Simple Frequency Counter	E,A
ETI 119	5 V Switching Regulator supply	E
ETI 120	Logic Probe	L,E
ETI 121	Logic Pulser	L,E
ETI 122	Logic Tester	E
ETI 123	CMOS Tester	E
ETI 124	Tone Burst Generator	E
ETI 128	Audio Millivoltmeter	L,E
ETI 129	RF Signal Generator	L,E
ETI 131	General Purpose power supply	E,N
ETI 132	Power Supply	N

SIMPLE PROJECTS

ETI 206	Metronome	E
ETI 218	Monophonic Organ	E,D
ETI 219	Siren	E
ETI 220	Siren	E
ETI 222	Transistor Tester	E
ETI 232	Courtesy Light Extender	E
ETI 234	Simple Intercom	E
ETI 236	Code Practice Oscillator	E
ETI 239	Breakdown Beacon	E

MOTORISTS' PROJECTS

ETI 301	Vari-Wiper	E
ETI 302	Tacho Dwell	E
ETI 303	Brake-light Warning	E
ETI 309	Battery Charger	P,E
ETI 312	CDI Electronic Ignition	P,E
ETI 313	Car Alarm	E,D

AUDIO PROJECTS

ETI 401	Audio Mixer FET Four Input	E
ETI 402	Guitar Sound Unit	E
ETI 406	One Transistor Receiver	E
ETI 407	Bass A.p	E
ETI 408	Spring Reverb. Unit	E
ETI 410	Super Stereo	E
ETI 412	Music Calibrator	E
ETI 413	100 Watt Guitar Amp	P,L,E,J,D
ETI 413	x 200 Watt Bridge Amp	E
ETI 414	Master Mixer	E,J
ETI 414	Stage Mixer	E
ETI 416	25 Watt Amplifier	E
ETI 417	Amp Overload Indicator	E
ETI 419	Guitar Amp Pre-Amp	P,E,D
ETI 420	Four-channel Amplifier	L,E
ETI 420E	SQ Decoder	E
ETI 422	International Stereo Amp	L,E,D
ETI 422B	Booster Amp	E
ETI 422	50 Watt Power Module	E
ETI 423	Add-on Decoder Amp	E
ETI 424	Spring Reverberation Unit	L,E
ETI 425	Integrated Audio System	E
ETI 426	Rumble Filter	E
ETI 427	Graphic Equaliser	L,E,J
ETI 430	Microphone Line Amp	E
ETI 433	Active Crossover	E,J
ETI 435	Crossover Amp	E,J
ETI 438	Audio Level Meter	L,E
ETI 440	Simple 25 Watt Amp	L,E
ETI 441	Audio Noise Generator	L,E
ETI 443	Compressor-Expander	E,J
ETI 444	Five Watt Stereo	E,N
ETI 445	Preamp	J,E,D,A
ETI 446	Audio Limiter	J,E,A
ETI 447	Phaser	E,J,A
ETI 449	Balanced Mic Preamp	J,A
ETI 480	50W, 100W Power Amp	A,J,D
ETI 480 P	Power Supply	A,J,D
ETI 482A	Preamp Module	A
ETI 482B	Tone Controller	A

MISCELLANEOUS

ETI 502	Emergency Flasher	E
ETI 503	Burglar Alarm	E
ETI 505	Strobe	L,E,D
ETI 506	Infra-Red Alarm	E
ETI 509	50-Day Timer	E
ETI 512	Photographic Timer	E
ETI 513	Tape Slide/Synchroniser	E
ETI 514	Flash Unit Sound Operated	E
ETI 515	Flash Unit Light operated	E
ETI 518	Light Beam Alarm	E
ETI 522	Photographic Timer	E
ETI 523	Sweep Generator	E
ETI 525	Drill Speed Controller	E
ETI 526	Printimer	E
ETI 527	Touch Control Light Dimmer	E
ETI 528	Home Burglar Alarm	P,E
ETI 529	Electronic Poker Machine	E
ETI 533	Digital Display	L,E,A
ETI 534	Calculator Stopwatch	A,D
ETI 539	Touch Switch	E
ETI 540	Universal Timer	E
ETI 541	Train Controller	E
ETI 543	Double Dice	A
ETI 544	Heartrate Monitor	A

ELECTRONIC MUSIC

ETI 601		
4600	Synthesiser	J
3600	Synthesiser	J
ETI 602	Mini Organ	E,A,D

COMPUTER PROJECTS

ETI 630	Hex Display	A
ETI 631	VDU Keyboard Encoder	A
ETI 632	VDU 1 k x 8 Memory Card	A
ETI 633	VDU Sync Generator	A

RADIO PROJECTS

ETI 701	TV Masthead Amplifier	E,D
ETI 702	Radar Intruder Alarm	D
ETI 703	Antenna Matching Unit	E
ETI 704	Crosshatch/Dot Generator	L,A,D,E
ETI 706	Marker Generator	E
ETI 707	Modern Solid State Converters	C,E
ETI 708	Active Antenna	E
ETI 710	2 metre Booster	C,E
ETI 711B	Single Relay Remote Control	A
ETI 711C	Double Relay Remote Control	A
ETI 711R	Receiver	A
ETI 711AR	Remote Control Transmitter	A
ETI 711DR	Remote Control Decoder	A
ETI 740	FM Tuner	A
ETI 780	Novice Transmitter	E

ELECTRONIC GAMES

ETI 804	Selecta-Game	O,A,D

Simple PCB drill

By A. J. LOWE

Drilling holes in a printed circuit board is not the easiest job. This project describes a simple hand drill press made of cheap available materials.

THIS PROJECT IS for the real do-it-yourself enthusiast — the one who makes his own printed circuit boards and is faced with the tedium of drilling them accurately.

There is a home-made drilling machine which, though not as fast as an electric drill press, certainly costs a great deal less, and takes a lot of the 'ill' out of drilling. This article can indicate only the general idea as final details must be settled to suit the material finally used.

As can be seen in the assembly photograph the machine is simply a support made from the base of a food mixer, with an ordinary hand drill attached. The drill does not move up and down, as in a proper drill press, but the drill table does. The table is forced upward against the drill by a spring below it. A hole in the centre of the table receives the drill bit once it has penetrated the printed circuit board.

So, to operate — you simply press down the table against the spring, slide the work into position below the drill and let the work rise by releasing pressure on the table. When the drill centres on the centre mark you start turning the crank of the hand drill. The upward thrust provided by the spring is enough to ensure good drilling without drill breakage. A couple of fingers remain on the work to stop it turning and ready to press down and reposition for the next hole.

Construction

The frame of the prototype is, as stated, the base of a food mixer. All you need is something with a horizontal table and a rigid upright.

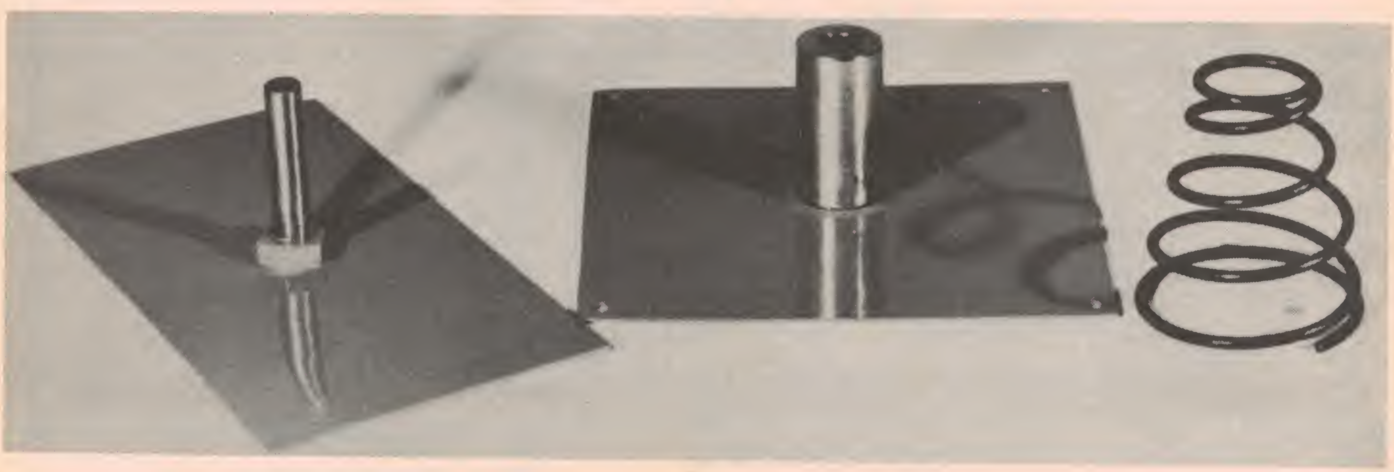
It's best to start construction with the table — because the height of it determines the necessary height of the drill and the angle of the outrigger arm attached to the base.

The table comprises three parts — shown in the detail photograph: the top table — on the left; the base plate and guide; and the spring.

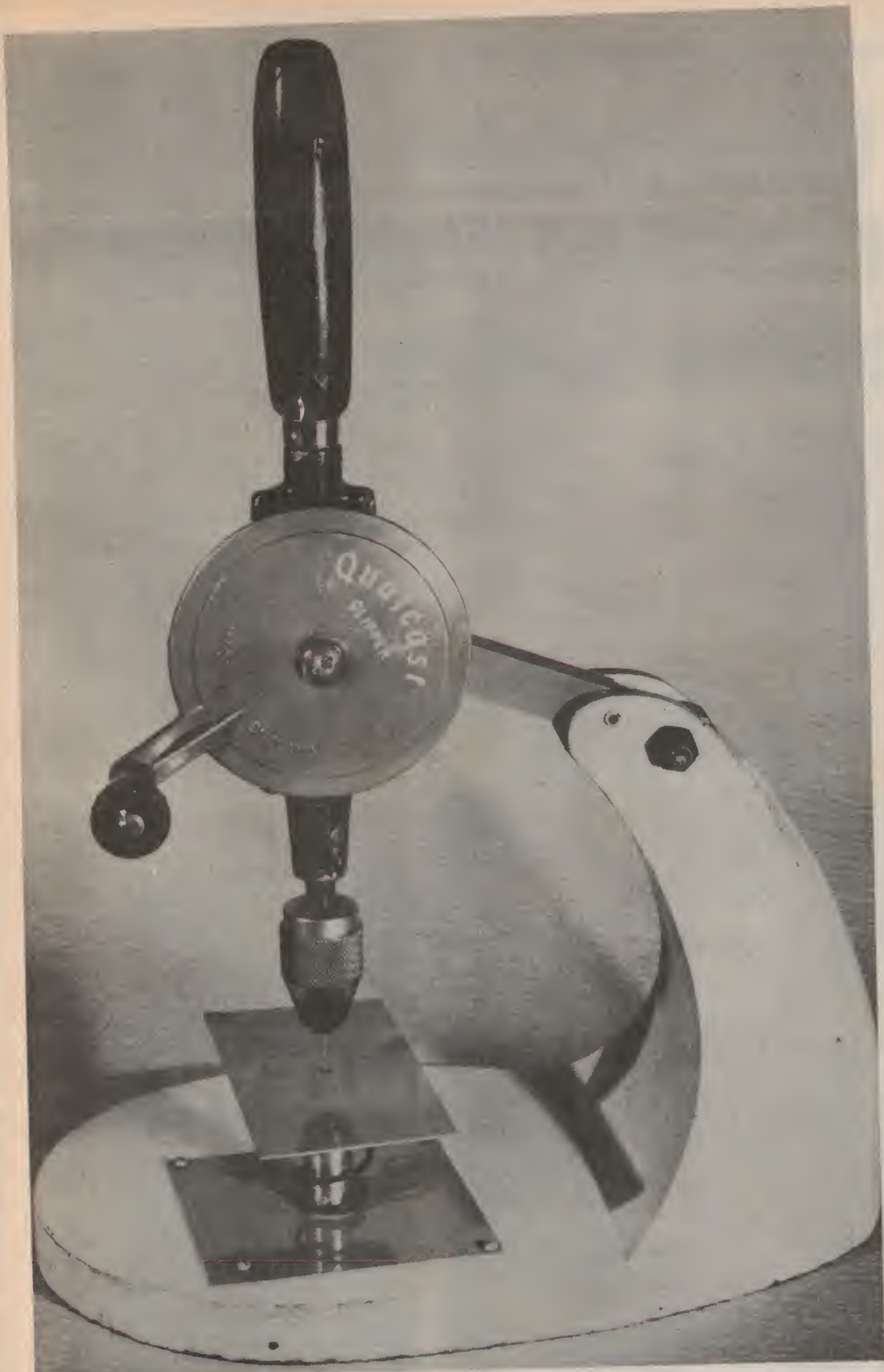
The spring should be about 45 mm long — uncompressed. It need not be conical — the spring selected for the prototype just happened to be so. The spring should be reasonably stiff so that when it is compressed about 7 mm there's enough push in it to cause a drill to drill holes. That's a bit vague but a little bit of squeezing a few springs will give the idea. Start at the garage or auto electrician and ask for any old springs about this by this and you'll get a range of springs — free most likely. Valve springs are too stiff. The spring used in the prototype came from a car door — fitted behind the window winder handle. It's just right.

Having got your spring you need to make the top table — from sheet steel, about 1 mm x 110 x 60 mm or any size to suit, and drill a central hole in it about 3 mm diameter.

You now need a ¼" bolt with about 28 mm of unthreaded portion on it. A good quality bolt with a machined finish is desirable. The head of the bolt should be flattened, preferably in a lathe (but a file will do) and then drilled, on axis, to a depth of 8 mm or



The three main elements of the table of the drill are the top table, the base-plate and guide, and the spring.



so and 3 mm diameter to receive the drill bit. This bolt is soldered square on to the top table and directly over the hole.

The guide for the bolt is a piece of brass or steel round bar with a suitable outside diameter for the spring chosen (the prototype is 15 mm O.D.). A hole to receive the bolt on the top table is bored right through the guide. This should be done on a lathe or a drill press.

The two parts should fit together freely but not loosely. The length of the guide should be selected so that it provides adequate guidance for the top table and yet allows enough movement of the top table to get suitable spring compression. The prototype is 30 mm long. As the sliding bolt acts like a piston in the guide a small vent hole should be drilled radially through one side of the guide close to the bottom.

The ends of the guide should be filed or turned square to its axis so that it stands upright.

The guide is then fixed by soldering or using an epoxy resin to the centre of a steel base plate. The plate in the prototype measures 1 mm x 90 mm square.

Now put the table together and see that it operates satisfactorily.

It should be stood on the base of the mixer and then the hand drill, loaded with a fine bit, held over it so that the bit enters the hole of the table when the spring is not compressed. The position of the hand drill — as far as height is concerned, should be measured carefully as it must be fixed at this height.

Having settled the height of the hand drill then the outrigger arm may be fixed to the base at such an angle that it can carry the drill at the right height.

The outrigger arm in the prototype is a 150 mm length of 16 mm square steel bar which fitted neatly into the top recess in the upright. This outrigger arm is bolted, using the original holes in the upright, and also fixed by means of a smaller bolt or spring pin so that it cannot move. Rigidity is essential.

The hand drill is then attached, at the height already determined, to the outrigger arm by means of a bolt passing through the arm and into the drill in place of the usual side handle. In some inexpensive drills the side handle is merely pressed on to a fixed steel rod. In this case the steel rod should be threaded and fixed to the outrigger arm with a nut.

Having mounted the drill adjust it until it is truly vertical and then tighten up the fixing bolt or nut.

Next place the table directly below the drill so that a drill bit centres in the hole in the top table. The position of the base plate is then carefully marked. Next, by means of four small bolts the base plate is fixed to the base of the mixer in the marked position. A coat of paint is the finishing touch.

Adjustment

A certain amount of adjustment is possible in this simple machine. The height of the bit in the drill chuck can be varied and the uncompressed height of the table can be increased by means of packing washers below or above the spring.

Wharfedale: Uncompromising dedication to true fidelity.

The discerning listener has long been aware of the absolute purity of 'uncoloured' English sound.

Wharfedale – Britain's largest manufacturers of hi-fi speakers – are dedicated to the design of speaker systems that exemplify this tradition.

Now Wharfedale speakers are fully imported into Australia.

Sold and serviced nationally by Rank Australia. Available at all leading Hi-Fi Specialists.

WHARFEDALE

Glendale 3XP. Larger bass drive than Linton with increased cabinet volume. Power handling 40 watts DIN.

Linton 2XP. Separate, specially designed drive unit for bass, midrange and treble. Handles power of 40 watts DIN.

Dovedale SP. 4 drive units including 2 small bass drivers for excellent bass response. Handles power of 60 watts DIN.

(Not illustrated)

Airdale SP. Top-of-the-range model with 4 specialist drive units in reflex-loaded enclosure. Power handling 100 watts DIN.

We Keep Performing

RANK AUSTRALIA

CU152/77

Leak 3000 Series: Computer designed for superior audio accuracy.

From the originators of high fidelity speaker design – the Leak 3000 Series.

A fully imported range of loudspeakers computer designed to reproduce your sound with authentic accuracy and the utmost clarity.

The 3000 Series is the result of an intensive research programme to evaluate and correct various audible distortions in such key areas as intermodulation, doppler and delayed resonance.

Now the Leak 3000 Series can deliver:

- Design control to compensate for time delay.
- Bass/mid range driver with no audible doppler distortion.
- Special compensating crossover network for improved treble performance.
- Treble unit with range up to 22kHz.
- Superb stereo imagery.

Hear the difference now at your leading Hi-Fi Specialist. Leak loudspeakers have never looked better, never sounded so accurate.

LEAK

NEW. FULLY IMPORTED.

We Keep Performing

RANK AUSTRALIA

CU151/77

Sansui Stereo Integrated Amplifier: The Super Power Package.

From Sansui, the Stereo Integrated Amplifier AU20000, a super power package that pushes out 170 watts per channel. We call it integrated because it is a combination of the Definition BA-3000 power and CA-3000 preamplifier within the one unit.

That means the AU20000 is more compact to handle and is available at a price to please every true audiophile.

Specifications

Power Output: Min. RMS, both channels driven, from 20 to 20,000Hz, with no more than 0.05% total harmonic distortion 170 watts per channel into 4 and 8 ohms.

Power Bandwidth: 20 to 20,000Hz at or below rated min. RMS power output and total harmonic distortion.

Total Harmonic Distortion: Overall (from AUX) less than 0.05% at or below rated min. RMS power output.

Intermodulation Distortion: (70Hz:7,000Hz = 4:1 SMPTE method). Overall (from AUX) less than 0.05%.

Frequency Response (at 1 watt):
Overall (AUX to power output)
10 to 50,000Hz + 0dB, −1.0dB
Power Amplifier Only
10 to 70,000Hz + 0dB, −1.0dB

Damping Factor: approximately 80 to 8 ohm load

Channel Separation at rated output 1,000Hz:
Phono 1–better than 55dB
(at 3mV sensitivity)
Phono 2–better than 55dB
(at 3mV sensitivity)
Tuner–better than 60dB
Aux–better than 60dB
Tape Monitor–1,2,3 better than 60dB
Power Amplifier–better than 65dB

Available from all leading Hi-Fi specialists

Sansui

Sold and serviced nationally by Rank Australia.
Sydney (02) 406 5666
Melbourne (03) 62 0031
Brisbane (07) 44 2851
Adelaide (08) 212 2555
Perth (092) 28 3933

We Keep Performing.

RANK AUSTRALIA

CU148/77

Project 133

PHASE METER

By Dr. P.C. Bury, Physics Dept., Victorian College of Pharmacy

This instrument measures phase angles of voltage, current or power from sub-audio frequencies to 100 kHz or beyond. Readout may be either digital or analogue.

THE POWER being dissipated in an ac circuit is one of the more difficult quantities to measure with normal laboratory equipment — unless the circuit is purely resistive. This is because the power dissipated is given by the expression P = IV cosϕ where I is current, V is voltage and ϕ is the phase angle between them. Theta (ϕ) varies from 90^{o} for an ideal inductance, through 0^{o} for a resistance, to −90^{o} for a capacitance. Since cos ±90 = 0, both inductance and capacitance dissipate no power at all. They store it during one half-cycle and release it to the source again during the following half-cycle.

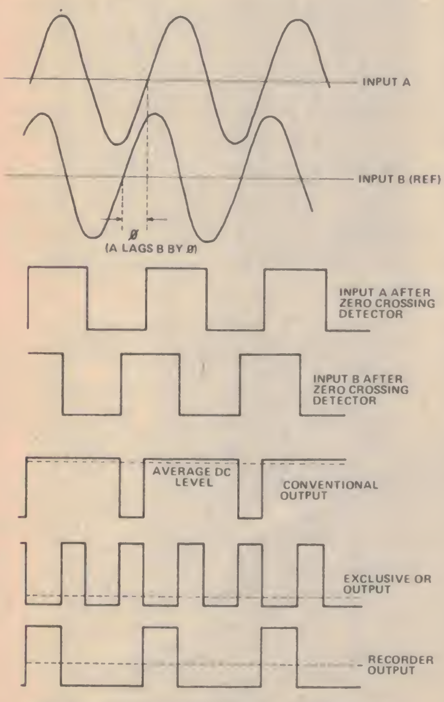


Fig.1. Comparison of the conventional 'flip-flop' method and the exclusive-OR method used in this project.

Therefore, in order to measure power, one either needs a wattmeter — an expensive instrument if any great accuracy is desired — or a knowledge of ϕ, the phase angle. While ϕ can be estimated from a dual trace oscilloscope, this article describes a simple and accurate way of measuring it directly. In addition to power measurements, measurement of the phase difference between two voltages is useful when working on filters, feedback loops and phase-shifting networks: it can be used to measure the Q of an inductor, and hence check for shorted turns, or the loss factor in a capacitor. A further application of growing importance in the audio field is the phase of the sound from individual drive units in a loudspeaker enclosure, or members of an array of loudspeakers.

The phase relationship between two voltages is conventionally measured by detecting when each crosses zero voltage (see Fig. 1) in one direction, and arranging for one voltage to turn a flipflop ON and the other to turn it OFF. The percentage of time that the flipflop is on, and hence the average value of the flipflop output, is proportional to the phase difference between the two voltages. This method has three inherent disadvantages —

(i) Voltages with little or no phase difference can give readings of 0^{o} and 360^{o}, or a reading which varies randomly between these limits.

(ii) Any noise on either signal can cause false triggering and jittery readings.

(iii) Any harmonic distortion can produce a shift in the zero crossing point and hence an error of 0.6^{o} for each 1.0% of distortion.

The method used in the circuit described here is to form the exclusive-OR of the square waves produced by zero crossing detectors from the two voltages.

For those who have not encountered the exclusive-OR (XOR) function before, this is a logic function (in the same way that AND and OR are logic functions) that gives an output (logic 1) if its two inputs are different, but not if they are the same. Thus two square waves which are in phase will produce no output: two which are exactly out of phase will produce a maximum continuous output; and intermediate phases will produce an output proportional to the phase difference (see Fig. 1). This system has the advantage of being almost immune from noise problems since no triggering or latching circuits are involved.

Because the circuit response is symmetrical about 0^{o} and 180^{o}, there are no output discontinuities or ambiguities of reading. However an additional flip-flop is required to sense which voltage is ahead of the other and indicate it. The circuit is implemented with CMOS gates which have the advantage of being able to be used in either linear or digital mode.

CONSTRUCTION

We assume that only the more experienced constructor will build a somewhat specialised instrument of this type, and that they will be capable of assembling, handling the CMOS, with due care, boxing it without step by step instructions. The pc board can be copied from the diagram (Fig. 3), or hopefully will be available through commercial channels. The layout of the components is shown in Fig. 4. Some care is needed to keep the input leads as short as possible as the gain of

Text continues on page 48

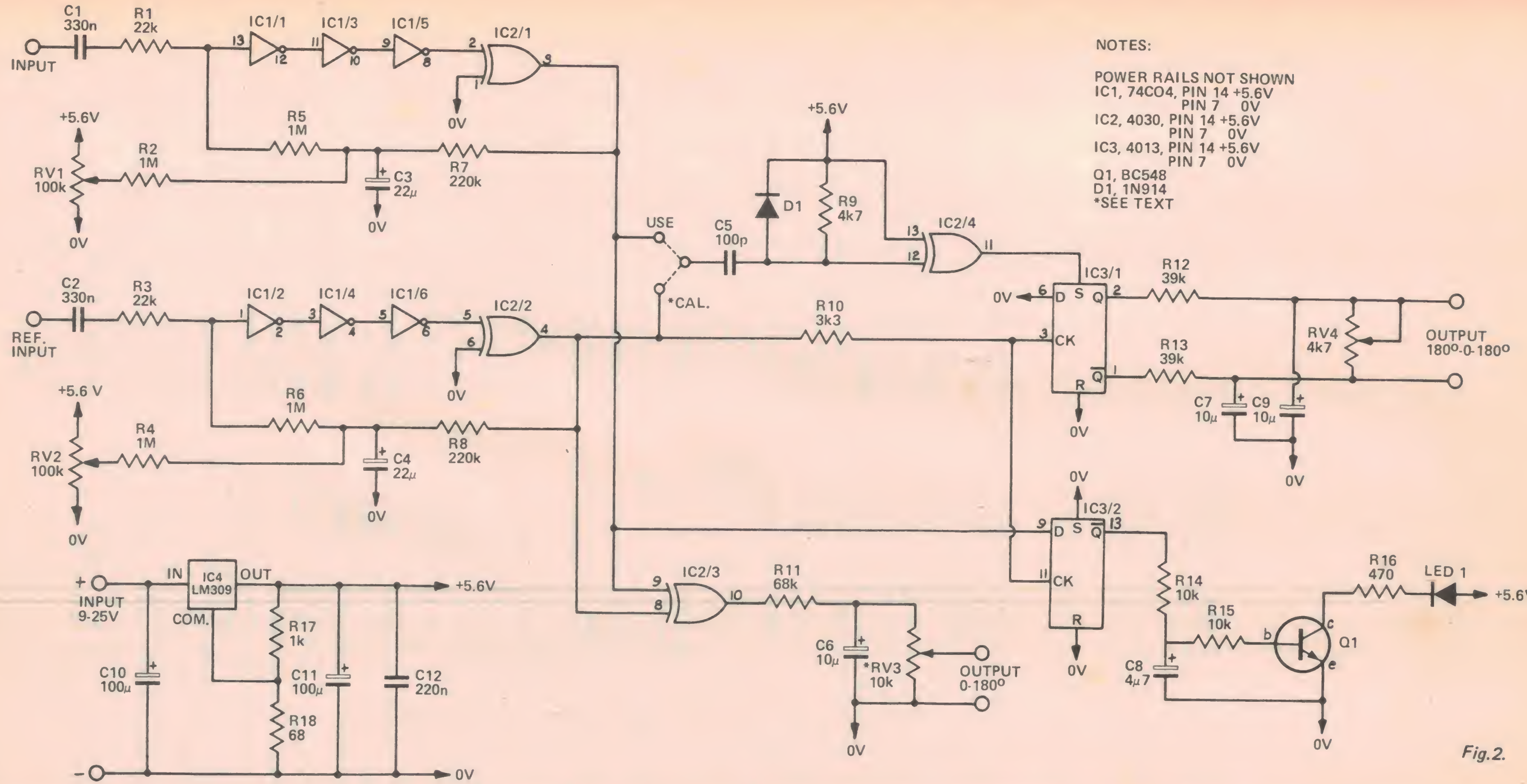


Fig.2.

HOW IT WORKS

The two inputs are first squared. For example the reference input is amplified by gates IC1/2, IC1/4 and IC1/6 (see Fig. 2) and then applied to IV2/2, one of the spare EX.OR gates whose other input is grounded. This conveniently behaves as a Schmitt trigger type of bistable circuit. The average of the output of this gate is formed by R8 and C4, and this is inserted via R6 as the dc level at gate IC1/2.

This produces two important consequences. Firstly it forces the output of IC2/2 to a symmetrical 180°on/180°off condition which is maintained stabely by almost complete dc feedback. And secondly it may be set to 180 mV for a 180° phase difference and read it on a digital multimeter. Alternatively up to 50 μA can be drawn to give a reading on any suitable meter or multimeter. The use of an external meter is of course a much more economical proposition.

In order to detect which of the inputs is leading the other, the two voltages from the squaring circuits are also fed to the D type flip-flop IC3/2. One voltage is used for the clock input and the other as a data input. This type of flip-flop is really a data latch, and whatever voltage is present at the D input at the moment when the clock voltage changes from low to high is held

would leave one flip-flop unused. In fact it turns out that there are two functions that these gates can usefully perform. First, for setting up the input squaring circuits: if the flip-flop is slaved to the squaring circuit, the exact 180° condition can be set when the complementary outputs Q and Q have equal average values. Secondly these gates can be arranged to turn the flip-flop on and off to give a conventional phase meter circuit output. While this does not give as accurate a reading, it does give one which is of opposite polarity for leading and lagging voltages and which can therefore be recorded graphically and unambiguously on an instrument such as a chart recorder. This is therefore des-

flip-flop is slaved to the reference input as it is set when IC2/2 goes low and reset when IC2/2 goes high, and this enables the 180° duty cycle to be set (see below). When C5 is connected to IC2/1 (the USE position) the flip-flop will have equal outputs at Q and Q if the two inputs are exactly in phase. It produces a positive value of Q relative to Q when the input leads the reference voltage and a negative value when it lags, the average voltage between them being proportional to the phase difference. R12, R13, C7, C9 and RV4 are used to filter this output and set it to some convenient value.

Of the other components, R10 is used to delay the voltage to the clock inputs

ly, because we now have a true squaring circuit rather than a zero-crossing detector, all errors due to even-order harmonic distortion are cancelled. R4 and RV2 are used to adjust for input offset and set the exact 180^{0} condition.

IC gates IC1/1, IC1/3, IC1/5 and IC2/1 process the signal from the other channel in an identical manner, and the two squared outputs are fed to gate IC2/3 which is the gate that forms the EX.OR of them. Its output is filtered by R11 and C6 and a voltage proportional to the phase difference of the inputs may be taken from across C6. RV3 is used to set this to a convenient value – for instance until the next clock pulse. Thus if the D input stays low until after the clock input goes high, the output Q will always remain low showing that the D input lags the clock input. The complementary output Q will be high and this is used to turn on the transistor and LED indicating this lag condition. Since any noise arriving at the clock input can cause spurious resetting of the flip-flop, it is preferable to use a clean voltage to drive it. This is why this channel has been designated the reference. Noise on the other channel is almost completely ignored.

These then are the basic EX.OR functional parts of the phasemeter, and this ignated the recorder output.

In operation one input of the EX.OR gate IC2/4 is connected through C5 to the output of one of the squaring circuits. Its other input is tied to the positive rail so that it functions as an inverter with respect to the other input (the EX.OR is a flexible beastie isn't it?). With C5 connected to the output of IC2/2 (the CAL position), when IC3/2 goes negative C5 and R9 differentiate this, and IC2/4 gives a short (½ μsec) positive spike, which is used to set IC3/1. Since the data input of this flip-flop is always low, the clock pulse will always reset it again. Thus the slightly to compensate for the set-up time at the data inputs, and the LM309 regulator and associated components holds the supply voltage constant at just under 6 volts. This is important as the full-scale readings from the outputs is proportional to the supply voltage. The circuit can be run from a 9 V battery and draws about 20 mA with the LED off and 40 mA with it on. Alternatively any power supply that produces between 9 and 30 volts may be used, but it should be a floating supply to simplify the measurement of the phases of currents, and R16 and the voltage rating of C10 should be increased if more than 15 volts are used.

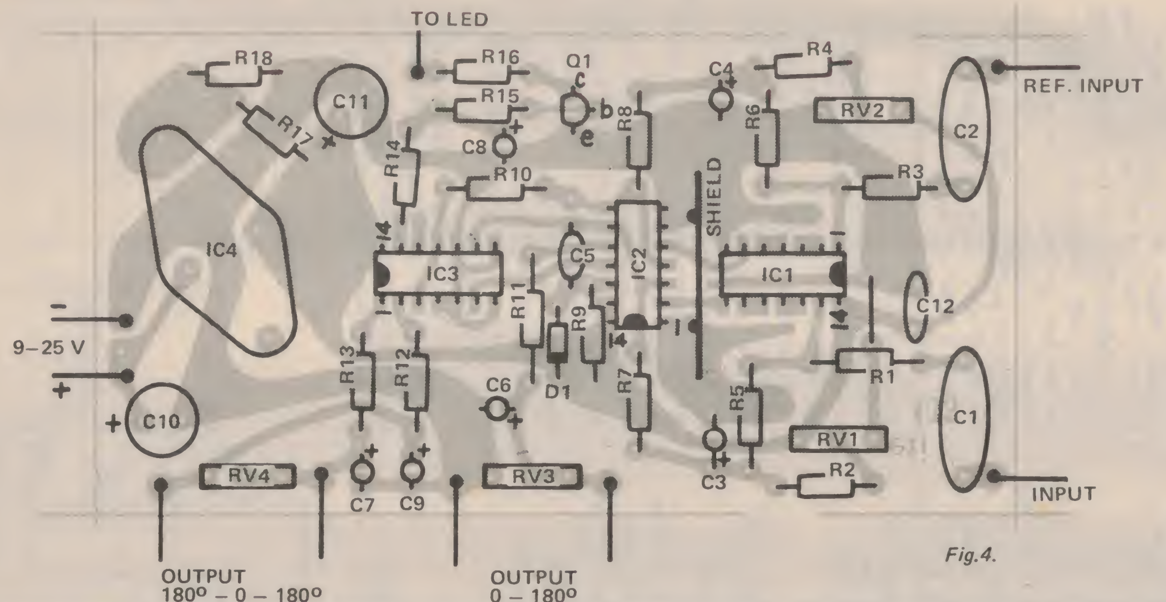


Fig.4.

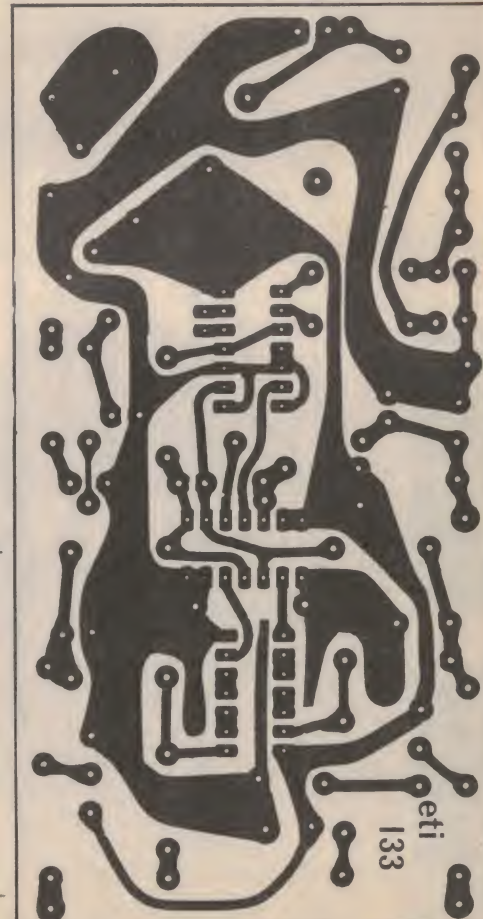


Fig.3.

PARTS LIST ETI 133

Resistors	all ½W 5%
R1	22 k
R2	1 M
R3	22 k
R4-R6	1 M
R7,8	220 k
R9	4k7
R10	3k3
R11	68 k
R12,13	39 k
R14,15	10 k
R16	470
R17	1 k
R18	68

Potentiometers	
RV1,2	100 k Trim
RV3	10 k "
RV4	4k7 "

Capacitors	
C1,2	330 n polyester
C3,4	22 μ 16 V electro
C5	100 μ ceramic
C6,7	10 μ 16 V electro
C8	4μ7 16 V
C9	10 μ 16 V
C10,11	100 μ 25 V
C12	220 n polyester

Semiconductors	
IC1	74C04 (CMOS)
IC2	4030 "
IC3	4013 "
IC4	LM309k
Q1	BC548
D1	1N914
LED	

Miscellaneous
PCB ETI 133
Case to suit
Terminals and sockets to suit

PHASE METER

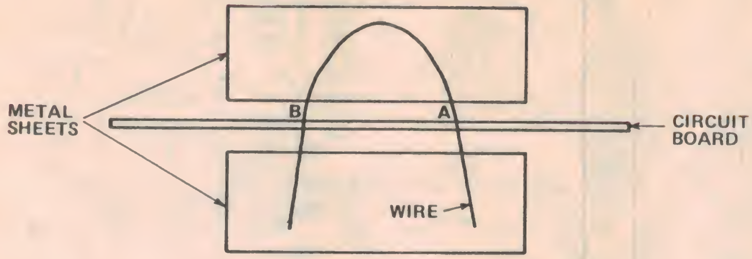


Fig. 5. Details of the shield between IC1 and IC2.

the input stage is extremely high and oscillation can occur if they become coupled to the later stages. To help isolation, small metal sheets, about ¾" x 1½" should be soldered above and below the board between IC1 and IC2. These can conveniently be attached to the link between points A and B in the circuit as shown in Fig. 5. For the same reason, the CAL and USE points should not be taken to a panel-mounted switch but the connection changed on the board itself. We have used two molex pins at these points, marked X in Fig. 4, which work quite satisfactorily.

When the board is assembled, it can be mounted behind the front panel, supported directly by stout wires to the two inputs and the recorder output. Connect a power supply and check that the voltage across C11 is six volts or just under. Calibration and testing are simplified if the leads of C11 and the positive lead of C3 and C4 are left long enough to be able to clip a lead thereon.

CALIBRATION

To calibrate the instrument, first connect capacitor C5 to the CAL position, the meter to be used to the recorder output and a signal of about 100 mV at about 1 kHz to the reference input. Adjust RV1 to give a null reading on the meter. Disconnect C5, leaving the end free, and adjust RV4 to give a convenient reading on the meter to correspond to 180° (eg 180 mV or 45 μA). If this is hard to set exactly, connect a fixed resistance in parallel with RV4 to give better control for any individual meter.

Next connect jumper leads from the positive sides of C3 and C4 to either side of C7 (i.e. one to V+, the other to V−, it doesn't matter which), connect the meter to the main output and adjust RV3 to give a 180° reading (with parallel resistance if needed as in the previous paragraph). Finally, remove the two jumper leads and connect one between the two inputs, connect C5 to the USE position and adjust RV2 slowly and carefully until the LED is just on the point of turning on and off. The meter should now be reading less than half a degree: if not, repeat the calibration procedure.

As a check of proper operation, you should now be able to vary the communal input from millivolts to volts and from sub-audio to over 100 kHz without the phase difference showing more than about one degree. Another excellent test is to connect different signal generators of different frequencies to the two inputs. The output should read exactly 90°, as the signals will be in phase exactly as often as they are out of phase. Our prototype failed this test, reading 92°, and it was only after considerable trouble that we traced this to non-linearity in our trusted (and expensive) multimeter. We guess the moral is to use a digital meter if accuracy is really important. Note that the recorder output is undefined under these conditions.

The high-frequency accuracy is limited by the rise and fall times of the CMOS outputs, by any mismatch in R1 and R3 and their stray capacitances, and by propagation delay differences between the two input and squaring circuits. These, on the two units tested, have been about 50 nsec. This would be equivalent to 1° phase error for every 25 kHz of signal frequency. Thus the meter is usable, but certainly not accurate, up to about one megahertz.

Input protection is provided by resistors R1 and R3 and the internal diodes in the 74C04. We have tested this system to inputs of 80 Vrms before any degradation of the gates occurred, but a value of say 25 Vrms (70 V p/p) should be regarded as a fairly safe working maximum. If IC1 is mounted in a socket, it can be simply changed if accidently overloaded. Under no circumstances can 240 V be applied directly to the inputs!

When using the instrument for measuring phase in 240 V mains circuits, common sense precautions should be observed to ensure no damage occurs to the instrument or the operator! First use a mains testing screw driver to identify the active lead: secondly always switch off the power when connecting or making any alterations to the circuit under test: thirdly make sure that the resistor R makes reliable contact and cannot accidentally become disconnected, otherwise the reference input can get the full mains voltage through the load. Finally use a voltage divider or an oscilloscope X10 probe to reduce the voltage to a safe level.

The circuit shown in Fig. 6 can be set up on an insulating board with a socket for the load to be plugged into. Resistor R is chosen to give a voltage of 1 volt or less when the load current flows through it and must be rated to dissipate a few watts if large currents are to be handled. A value of 0.22 Ω, 5 W is suitable for most situations. And remember that, when set up like this, the instrument reads the phase of the voltage relative to the current.

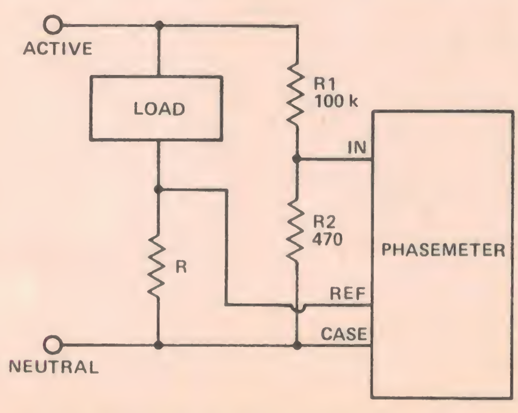


Fig.6. How to use the meter to show the relative phase of mains voltage to mains current.

ANNOUNCING NORTH SHORE'S NEWEST DEALER

PARAMOUNT ELECTRONIC SERVICES

(A DIVISION OF PARAMOUNT COLOUR ENGINEERING PTY. LTD.)

An I.C.S. DISTRIBUTOR TO THE ELECTRONICS INDUSTRY. THE LARGEST OFF THE SHELF RANGE OF QUALITY BRAND NAME COMPONENTS.

The largest off-the shelf range of quality brand-name electronic components.

Semi-Conductors
Delco
E.D I.
General Electric
Intermetall
I.T.T.
National
N.E.C.
Philips
Sanyo
Signetics
Solid State Scientific
Texas Instruments

Passive Conductors
A.E.E.
Bournes
Clarostat
Elna
I.T T. Capacitors
I.T.T. Thermistors
Philips (Elcoma)
R.C.A.
Soanar
Sprague

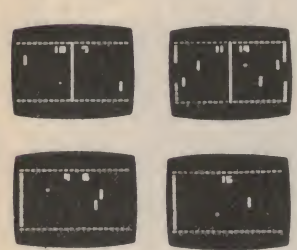
Electro-Mechanical and Hardware
Acme
Alco
Augat
Cannon
Deko Heatsinks
I.T.T. Diecast Boxes
I.T.T. Fans & Blowers
Dica I.C. Accessories
I.E.E.
I.T.T. Relays
Jean Renaud
J.A.E.
National Relays
Pomona Accessories
Roton Fans & Blowers
Switchcraft Connectors
Thermalloy Heatsinks

ICS ICS ICS

ASK FOR
Free 200-page
I.C.S. STOCK CATALOGUE
with every
purchase over $20.00

ICS ICS ICS

APPOLLO VIDEO GAMES



BLACK & WHITE KIT	$52-50	P&P INCL. See February issue for full details
ETI 804 KIT	$52-50	
COLOUR KIT	$84-50	
COLOUR PROCESSOR KIT	$36-50	
RIFLE KIT	$25-00	
FULLY ASSEMBLED B & W	$66-50	
FULLY ASSEMBLED COLOUR	$99-00	

Manufactured units include AC Battery Adaptor . . . not included in kits.

C B RADIOS **FROM $49-00 OUR SELECTION**

ELECTROPHONE C B 235 JUST LOOK AT THESE SPECS. OUR PRICE $159-00

SPECIFICATIONS

Receiver
Circuit Type .... Dual conversion superheterodyne: Crystal frequency synthesixer provides 23 crystal controlled transmit and receiver channels. "Delta" tuning of 2KHz on each channel plus ceramic filter.
Sensitivity .... 0.7 V for 10dB S/N to N ratio
Selectivity .... —6dB down at 6KHz, 50dB down at 20KHz
Intermediate Frequency .... 1st IF: 10.595MHz to 10.635MHz, 2nd: 455KHz
Audio Output .... 3 watts into ext. speaker jack: 8 ohms
Auxiliary Circuits .... Switchable noise limiter, Variable squalch, PA, S/P-RF meter

Transmitter
Final Stage D.C. Power Input .... 5 watts maximum
Carrier Deviation .... Exceeds FCC requirements
Harmonics Suppression .... Exceeds FCC requirements —50dB or better.
Antenna Matching .... Nominal 50 ohms

A GOOD RANGE OF C B ACCESSORIES IN STOCK. CURRENT ETI & EA KITS ALSO AVAILABLE.

NOTE OUR NEW ADDRESS: 47-49 JERSEY STREET, HORNSBY. N.S.W. 2077
MAIL ORDER: P.O. Box 301, HORNSBY. N.S.W. 2077 PHONE: 476-5911
MON. — FRI. 9.00 to 5.30 SAT. 8.30 to NOON


"Let's make it at your place"
DYNACO DYNAKITS have an international reputation for value-for-money high fidelity quality in performance and musical excellence.
If you want giant results and savings too, "LETS MAKE IT AT YOUR PLACE" with DYNACO DYNAKITS.
• Pat 4 Preamplifier • Pat 5 Preamplifier • Stereo 80 • Stereo 150 • Stereo 400 • Power Amplifiers • AF6 AM/FM Tuner • FM5 FM Tuner • QD.1 Quadaptor
dynaco
dynakit

CB AUSTRALIA

Vol. 1 No. 3 60c*

How to get into CB Radio

CB CLUBS

CB ACCESSORIES

CB ACCESSORIES – DICK has the best!

NEW SHIPMENT JUST ARRIVED

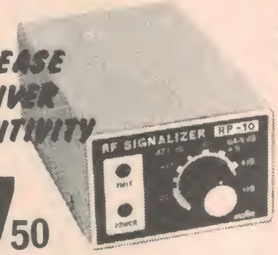
CB RADIO CONVERTER $33

Listen to the CB bands on your car radio.

Receives 26.535 — 27.610 MHz, converts it to normal AM band. Extremely simple installation; can also be used with other radios with correct fittings. 12V DC. Also supplied with additional crystals to cover up to 27.880 MHz marine frequency.
Cat. D-3829 .. .. $33.00

ANTENNA ELIMINATOR $27.00

Use your normal car radio antenna for CB transmission! No-one can tell you've got a CB with this fantastic eliminator. Very easy installation, SWR less than 1.5:1. Complete with instructions & fittings.
Cat D-5516 .. .. $27.00



INCREASE RECEIVER SENSITIVITY $47.50

Increase the sensitivity of your rig! RF signaliser amplifies weak signals, lets you pick up stations like never before. Or lets you cut back very strong local stations and so avoid overload. Variable from −20dB to +15dB. Cat D-3828 .. .. .. $47.50

PLUGS

$1.45 **PL259 Plug:** as used in almost all CB radio equipment— sturdy construction; easy connection. Cat P-2310 .. .. $1.45

$0.50 **Reducing adaptor:** necessary if you wish to use RG58U or sim. small dia. co-ax with the above plug. Cat P-2360 .. .. . $0.50

$1.20 **Cable joiner:** most cables are made with 2 x PL259 plugs. To join them, use one of these double ended joining sockets. Cat P-2380 .. .. $1.20

$2.85 **Right angle adaptor.** PL259 plug one end, then right angle bend, then SO239 socket. Handy where space behind a rig is limited. Cat P-2382 .. .. $2.85

$2.50 **Dummy load:** Perfect 52 ohm match, inside a PL259 plug. 5W rating, ideal for CB transceivers. Cat D-7022 .. .. $2.50

BASES

$8.50 **Gutta grippa:** Sturdy, non corroding alloy. Very easy to fit. Cat D-4625 .. $8.50

$8 **Antenna Lead Assembly** 3.5m co-ax, with fittings. For D-4615, 4623 & 4625. PL259 plug supplied. Cat D-4624 .. .. .. $8.00

$11.50 **Magnet Base:** Incredibly powerful magnet; fits D-4615 antenna. Nylon gasket stops scratches. Cat D-4623 .. .. .. $11.50

ALWAYS IN STOCK: Tremendous range of all CB accessories, test gear, antennas, base supplies, plugs & sockets, cords, etc etc etc . . . and RIGS.

WHITE FLASH

D-4076

WHITE FLASH HELICAL ANTENNA

Brand new, exclusive to Dick Smith, the 'knight of the road' helical antenna. Includes base, lead-in, PL259 plug. **Value!**
Cat D-4076 .. $29.00

D-4450 D-4615 D-4412

Mounts without holes! Boot or bonnet lip mounting with simple clamp attachment. Or you can mount it with a hole in the middle of the roof for optimum propagation characteristics. Base loaded, stainless steel whip. Cat D-4450 .. .. $27.50

Base loaded stainless steel whip includes PL259 plug in base to accept a number of bases (magnetic, etc) Rod adjusts for precise SWR. Cycolac base. Cat D-4615 fits D-4623 base $11.50

Centre loaded mini-mobiles: Magnetic base (as illus) or gutter gripper. Just 550mm high, easily adjustable for SWR minimum. Easy to store to prevent vandalism (or pinching!) Cat D-4412 (Mag base) $22.50
Cat D-4411 (Gutter gripper) .. $19.50

AS USED BY HANS THOLSTRUP CROSSING BASS STRAIGHT.

DICK SMITH ELECTRONICS GROUP

HEAD OFFICE: Phone 439 5311 Telex AA20036 Cable 'Diksmit' Sydney
MAIL ORDERS: P.O. Box 747 Crows Nest, NSW 2065
N.S.W. BRANCHES: Gore Hill — 162 Pacific Hwy, 439 5311
Sydney — 125 York St, 29 1126 Bankstown — 361 Hume Hwy, 709 6600
INTERSTATE BRANCHES: QLD — 166 Logan Rd, Buranda 391 6233
VIC — 656 Bridge Rd, Richmond 42 1614

SEE THE OTHER DICK SMITH ADVERT. FOR THE FULL LIST OF DEALERS

CB AUSTRALIA

Vol.1 No3.

How to get into CB Radio

CB How to get into CB Radio AUSTRALIA

Editorial:

Steve Braidwood, BSc (Hons), VK2BSY
Roger Harrison, VK2ZTB

Advertising:

Sydney — Bob Taylor, Geoff Petchler, Tel 33-4282
Melbourne — Tom Bray, Poppe Davis, Tel 51-9836

Publisher:

Collyn Rivers

This, the third issue of CB Australia, has been edited and produced by the staff of Electronics Today. It is presented free within the April 1977 issue of Electronics Today, and will also be available at the (recommended) price of 60 cents from all newsagents.

CB Australia is published by Modern Magazines (Holdings) Ltd, 15 Boundary Street, Rushcutters Bay, NSW 2011. It is printed by Wilke & Co, Browns Rd, Clayton, Victoria. Issues within Electronics Today are distributed by ACP, other issues by Gordon & Gotch.

A MODERN MAGAZINES PUBLICATION
15 Boundary Street, Rushcutters Bay, NSW 2011

COVER: If your hobby is boating or fishing you can legally use 27 MHz gear — if you belong to a club that has a P&T licence (but you are limited in the channels you can use).

STAY COOL

Things are hotting up on the CB front. With the legalisation of hobby CB expected soon some pirate operators are forgetting that they are breaking the law and they are abusing the (unofficial) 'blind eye' policy of the law enforcing agencies. They can only be a tiny percentage of the 'Legalise CB' lobby but those people who phone threats to RIs and harass them in their work are undoing the good work done by sensible campaigners.

And I think the NCRA request for an amnesty for illegal CB users shows a certain amount of naivety. Why should the government grant such a favour? Previous amnesties have involved the law-breaker *ceasing* to break the law in return for a waiving of charges. But suppose an amnesty was granted, that would mean hobby CB was 'legal' and the present problems would multiply as previously hesitant enthusiasts rushed to the shops to buy transceivers. What then would happen if the government decided that a CB service would be legalised on UHF only?

But it is not just the CBers who have been rash. The recent confiscation of CREST equipment in Sydney by Radio Inspectors took many of us by surprise. But perhaps it was the blatant way that channel nine was being used illegally that made them step in.

So stay cool, there's not much longer to wait — Mr Robinson has indicated that he will submit his department's ideas to the Cabinet in a few weeks time.

S.B.

CONTENTS

CB NEWS

23 Channel Rig for $29.95!

A 23 channel AM transceiver with separate RF and squelch controls and S/RF meter for only $29.95. But that's America — who knows, we might have prices like that in Australia soon.

CB Marketplace

Got a spare AM rig, now you've gone sideband, or a spare 108-inch whip, left over from before you sold the Landrover? You can now advertise these products free of charge in CB Australia. This offer applies to all readers except those who sell gear professionally. To place your ad seal an empty envelope and type your message on the back. Try to limit the copy to 12 words per item and don't forget to add your address or phone number. Put our address on the front — CB Marketplace, CB Australia, Modern Magazines 15 Boundary St, Rushcutters Bay, NSW 2011. We are only interested in equipment for 27 MHz stations — so don't try to send us ads for lawn mowers or trailers, etc.

Citizens'/Amateur Submission

We have received from Sam Voron, VK2BVS, the final submission from the Citizens' Amateur Radio Movement to Eric Robinson, Minister for Posts and Telecommunications. The submission was written after many meetings between officials of the WIA and the NCRA and the radio amateurs and CBers they represent. The CARM proposes two new items of legislation:

(1) Instigation of a communicator amateur class D licence for those interested in hobby communication and community service on the 27 MHz band.

(2) A short-range business and personal non-hobby service on the UHF band.

In addition to specifying sample restrictions for the proposed class D licence (such as type-approval for gear, a 5W (AM), 15 W (SSB), power limit, no overseas QSOs) the submission has some interesting recommendations for the amateur licence structure as a whole. It suggests that holders of the limited licence (presently prohibited from communications below 30 MHz) be allowed to use 27 MHz — for the first time holders of all three (and all four if the fourth class is adopted) classes of amateur licence will be able to communicate on the same frequency.

And it is also suggested that the prohibition on third-party communications be dropped in relation to amateur community service activities.

That is a very brief resume of the submission. In a future issue we hope to look in more detail at some of the CB service proposals that have been submitted to the government.

NCRA Goes to Canberra

On Sunday 13th March the NCRA organised a convoy to Canberra (from the state capitals) to present a petition to the government. The petition asked for a CB service to be introduced using the 23-channel 27 MHz band. And this should be followed by the introduction of a VHF/UHF CB service.

In addition the NCRA asked the government for an immediate amnesty for current CB users. A couple of days later NCRA officials met Mr Robinson. He said he was disappointed at the poor response to his request for submissions and that his department would be making recommendations to the Cabinet in a few weeks time.

CB from Electronic Agencies

Electronic Agencies sent us an interesting range of CB accessories when they read that we were featuring them in this issue. They included an interesting floor-mounting bracket that fits over the centre transmission hump of your car, an SWR bridge and field-strength meter (for $19), a hot-line suppression filter and a coaxial lightening filter and arrestor. Also included were a range of PL259 plugs, adaptors, and joiners; a press-to-talk microphone and magnetic clip holder and spare plug; plus an extension loudspeaker (with noise filter built-in) and three antennas (one base-loaded, one helical and one AM/FM/CB type).

NCRA News

At a national meeting on 17th February the NCRA appointed the following interim club delegates to the state executive:

NSW

J. Hemsley	(BPA34)	Barrenjoey Peninsula Area CB Club
G. Rowling	(LA5)	Lakemba Area Radio Club
F. Perlenfein	(ESA5)	Eastern Suburbs Area CB Club
J. Gorgon	(CW46)	Central West CB Club – Orange
T. Jennings	(BA100)	Bay Area CB Club
M. Braithwaite	(BC09)	Banana Club – Coffs Harbour
R. Grinly	(MA5)	Murrumbidgee Area CB Club
M. Lowe	(WD3)	4 Wheel Drive CB Club
J. Kuwahata	(NS28)	North Shore Radio Society
G. Cook	(SD21)	St George District CB Club

Victoria

Neil Langford		VCCBO
Neil Sleep		Landcruiser Club (Vic)
David Helyar		ACRM (Vic)

South Australia

Phil Richards		ACRM
George Boyd		NCRA

Queensland

John Sands	(CR4001)	Citizens' Radio Social Club of QLD

ACT

Mike Hurst-Meyers	(CT14)	Capital Territory CB Club

Northern Territory

John Tate		Darwin Radio Club.

This establishes a state-level executive responsible to the national body on behalf of the affiliated members in each state.

In another motion Mike Hurst-Meyers was empowered to create the National Citizens' Radio Directory.

The following clubs were represented: BA, BC, BPA, CARC, CRSCQ, CT, CW, DC, ESA, HV, KBW, KT, LARC, LX MA, NR, MSRS, NW, QCBSC, RD, RS, SD, ST, TCC, TLC, TR, VCCBD, WD, WWP, and XT

QUALITY CB GEAR

When you buy from VICOM you get only quality gear sold and serviced by the experts. All transceivers are given a thorough pre-delivery checkout supported by technical expertise and well equipped workshops. A wide range of spare parts is available and all new gear carries a 90 day warranty.

HAM AND NOVICE USE

PANTHER

synthesised $279

PANTHER SSB DELUX TRANSCEIVER

This superb rig is the ultimate in quality and sophistication! The Panther SSB is synthesised and requires no crystals - frequency stability is within 0.001%! There are 69 available modes: 23AM, 23LSB, 23USB at 5w am and 15w pep input. Controls include squelch, effective noise blanker and transceiver PA system switch. Front panel meter indicates modulation, "s" points or relative RF output. The rig comes complete with mic, mobile mounting brackets, dc cable and VICOM 90 day warranty. A real bargain!

HAM AND NOVICE USE

BUILT-IN SWR BRIDGE!

$159 COUGAR

COUGAR 23 B AM DELUX TRANSCEIVER

Delux mobile 23 channel (synthesised) for the quality conscious Novice. The Cougar features built-in swr meter, noise blanker, delta tune, rf gain control, mic gain control, built-in modulation meter, separate PA switch. Circuitary consists of 1 IC, 20 transistors, 18 diodes. RECEIVER: dual conversion, sensitivity 0.5 uV for 10 dB S+N/N, selectivity 6 dB bandwidth 5 kHZ, PA audio power 5 watts. TRANSMITTER: 5w input, spurious harmonic suppression better than 55 dB. Comes complete with mic, mobile bracket, dc cable and manual. *

TVI FILTER

$20

Superb quality low pass filter (32MHz cut-off) for transmitters 1.8 thru 30MHz. Insertion loss under 0.5dB, input/ output impedance 50 ohms. Complete with S0239 sockets. Will handle 200w pep (max) $20 + P&P $2
1Kw pep model (0.3dB insertion loss) $34 + P&P $3

POPULAR VC2 SWR/PWR METER

The popular VC2 covers 3-150 MHz with power measurement 12/120 watts. Will handle up to 1000w. 50 ohms impedance, twin meters. This quality tru-line instrument is ideal for the shack or for permanent mobile installation. $36 + P&P

$ 36 SWR/PWR METER

VICOM DEALERS WANTED

Vicom are seeking active Dealers to join our expanding Australian-wide CB retail outlets. We sell only quality gear and "get rich quick" outfits need not apply. Would-be Dealers should have technical facilities and personnel who are capable of handling and assisting with queries from our many customers. Written applications should be address to the attention of Managing Director.

A licence is required for all transmitting equipment.

ANTENNAS

BASE LOADED WHIP

Model M1 quality base loaded mobile whip, 40.5 inches long, 50 ohm impedance, vswr less than 1.5. Includes roof mount and optional boot lid mount, spring and coax with PL259 plug. $27 + P&P
Model G2 as above with gutter clamp $29.90 + P&P

HELICAL WHIP

Model HW-11S-6 6ft helical whip, covered in tough plastic, this top loaded (helical) is designed to give a perfect 52 ohm match. $22 + P&P
- spring base $13
- roof base $17.50

MARINE WHIP

Model HW-11-6M requires no ground plane and can be operated on fibreglass, wood surface or on mast. Comes complete with matcher, coax, PL259 plug. $65

HUSTLER CENTRE LOADED WHIP

Ideal mobile whip, mounts on bumper bar.

Whip	$19
Mast	$26
Bumper Mount	$19
Spring	$11.50

$79

27MHz ground plane, superb quality, wound on strong fibreglass rod with teflon protection. $79

¼ wave high efficiency ground plane, solid 108 inch heat treated radials and radiator. Radials droop for 50 ohm match. Complete with S0239 socket. $35 + P&P $3

LIGHTED DUMMY LOAD

5w dummy load built-in to a PL259 plug. Glows and indicates modulation, power output etc. $2.90

$2.90

JUMPER LEADS

Handy 3ft jumper leads,

RG58 coax with fitted PL259's $2.50
18" version $2.30

the COMMUNICATIONS SPECIALISTS

Mic Compressors

for those extra "s" points

$65

Model MC33A ac/dc includes two tone generator and built-in compression level meter. Handles low and high impedance mics with distortion better then 0.5%. Compression level -3 dB to -35 dB. $65 + P&P
Model MC22 as above (excl compression level meter) $54 + P&P

FOR THE SERIOUS SWL!

SWLs

BARLOW WADLEY

The famous portable Barlow Wadley Communications Receiver with crystal controlled reception of am/lsb/usb/cw:

Standard model	$319
With FM	$339

ANTENNAS

Listener-1 "V" type covers 3-30MHz with special trap for DX reception $22
Listener-3 long range wire dipole antenna 3-30MHz complete with balun, feed wax, VHF plug, insulators. Ideal for the serious SWL $49

SWL ANTENNA COUPLER

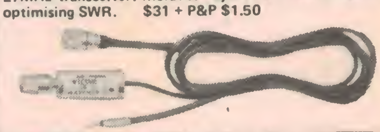
For matching receiver to the antenna line, this quality product handles signals from 2-30MHz with an output impedance from 50 to 600 ohms.

RECEIVER BOOSTER

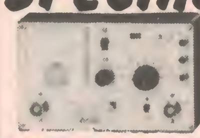
This preselector improves the selectivity and sensitivity of your short wave communications receiver. It covers four bands from 2-30MHz with a gain of 15dB! $35 + P&P

CAR RADIO SPLITTER

Permits operation of your AM or AM/FM car radio from 27MHz antenna. Can be used with any series fed (ungrounded) 27MHz antenna. Finished with RG58/u and car radio high impedance lead, each 60 inches long. Excellent isolation between entertainment radio and 27MHz transceiver. Includes adjustable 27MHz match for optimising SWR. $31 + P&P $1.50



SPECIAL !



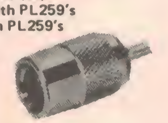
27MHz TEST SET

$45

Model FS-117 has built-in wattmeter and 5 watt dummy load, measures swr, modulation, field strength, crystal activity. Ideal for home repairs and "tweeking".
PRICE THIS MONTH ONLY $45 + P&P $3

SAVE $10

PLUGS & SOCKETS FOR THE COMMUNICATOR



4 pin mic plugs and sockets (ea)	$2.30
1½' coax jumper leads with PL259's	$2.30
3' coax jumper leads with PL259's	$2.50
PL259 plugs	$1.30
S0239 chassis sockets	$1.30
S0239/RCA adapter	$2.20
"T" connector	$2.50
Lightning arrestor	$3.50

COAXIAL SWITCH

$22

CS201 quality 2 position coax switch. Will handle up to 2.5Kw pep. 50 ohms impedance with insertion loss better than 0.2dB! VSWR better than 1.2 up to 1GHz. Position not selected is automatically grounded.

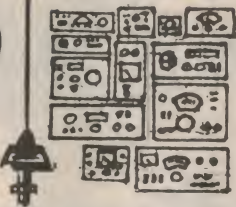
VICOM

Head Office & mail orders . . .
139 Auburn Rd, Auburn, Vic. 3123 Ph: (03) 82-5398

Vicom CB gear also available at –
Sydney: Jack Gillham, 23 Whiting St, Artarmon. Ph: 439.1271
Canberra: Daicom Electronics, 29 Colbee Crt, Phillip. Ph: 82.3581
Adelaide: Graham Stallard, 27 White Ave, Lockleys. Ph: 43.7981
and a networkof Dealers throughout Australia. Dealer enquiries welcome.

CONDITIONS OF SALE
Prices include sales tax but exclude freight and insurance. For insurance allow $1 per $100, min $1. Freight sent Kwika sair (freight "collect") unless otherwise specified. Prices and specifications subject to change without notice. The law requires that a licence must be held for all transmitting equipment.

CB RADIO AND ACCESSORIES



WE'VE GOT THE LOT!
DEAL RIGHT! PRICE RIGHT

CB RADIO POWERMATE

E.A. January issue 240V input, 13.6V DC output at 1.5A. Complete kit to power your CB radio at home.
$16.50

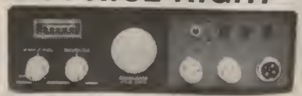
CB SPECIAL!

NEW 23 Channel Compact Transceiver
Mini-Mobile with all the best features plus high power output. PA, squelch, complete, 3 mths guarantee.
ONLY $70

SYNTHESIZED TRANSCEIVER SK 515 $105.00

23 Ch operation, freq synthesizer with 14 Xtals, freq tolerance 0.005/, 5W input to final amplifier, AM only, dual conversion superhet receiver, sensitivity 1uV at 10dB S/N, features 32 semiconductors, large S/PWR meter, PA, ANL, DELTA TUNE, SQUELCH etc. Limited quantity only.

SSB RIGS



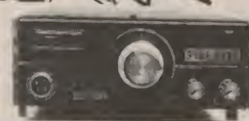
GEMTRONICS 12W PEP.

AM or SSB, 23 Ch. freq. synthesized operation, dual conversion on AM, 25W PEP input, 12W PEP RF output on SSB, 4W RF output on AM. Controls — SQUELCH, FINE TUNE, LSB-AM-USB, NB, PA, RF ATT, large S/PWR meter, 3months guarantee.
$229

CB RADIO

AT BEST PRICES! Come, See & Hear For Yourself Now.

5W MARINE CB 27.880 MHz



6 Channels.
"SIDE BAND BRAND" Rig, PA, ANL, Squelch, S/PWR meter, 3 mths guarantee, ext. speaker socket or inbuilt speaker. **$109**

23 CHANNEL 5 WATT $109

De-luxe model, 0.5uV for 10dB S/N, 6dB bandwidth selectivity, 50dB minimum spurious rejection. Features local/Dist. switch, PA facility, Squelch etc. etc. Owners manual incl. circuit, parts list, installation insts.

CB ACCESSORIES

Trade prices available on application on official letter head.

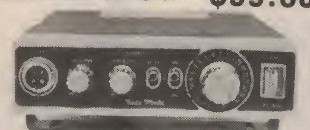
Plugs, Connectors and Cables.

Part No.	Description	Price
PL-259	HF Co-Axial Plug	$1 20
PLA-1	Adaptor for PL-259 plug. for RG58/U cable	28
PLA-2	Adaptor for PL-259 plug. for RG59/U cable	28
PLA-3	Adaptor for PL-259 plug. for 75 ohm cable	31
PLA-4	Adaptor for PL-259 plug. for 75 ohm cable	31
SO-239	Panel Socket with flange. suit PL-259	$1 25
SO-239/A	Panel Socket without flange. suit PL-259	98
PL-258	Cable joiner. double female. suit PL-259	$1 25
M-258	Cable joiner. double male. suit SO-239	$1 65
M-358	Cable joiner. "T" Connector (Double female and male)	$3 90
L-258	Lightning Filter and Arrestor (PL-259 plug to SO-239 socket)	$4 75
D-258	Dummy Load-with indicator lamp for transmitter power of 5 watts. 50 ohms impedance. PL-259 plug	$3 00
PC-258	1 metre Cable Assembly — RG 58/V cable with PL-259 plug each end — suit SWR and other test meters etc	$4 30
MP-4	CB 4 pin microphone plug	$1.50
CC-2	Mic Cable-3 conductor. single shield curly-cord. colour black	$1 75
RG-58/V	Cable. 52 ohm low loss. black-per metre	45
	or per 100 metres	$28 50

Accessories Part No	Description	Price
DM-95	Omni-Directional Hand-held Dynamic Microphone — with 2M curly-cord Imp 500 ohms. Freq Resp 20Hz-10KHz. Sensitivity — 70dB	$6.35
K-815	Extension Speaker 8 ohms 5 watts. with mounting brackets and ON-OFF	$13.50
MH-40	Microphone Holding Clip — magnetic mounting to car dash etc	75
MH-25	Microphone Holding Clip — with 2 self-tapping screws	.75
HL-1	"Hot-Line" Filter-reduces ignition interference — comprises choke and capacitor insert in 12V pos. lead	$3 10
SWR-300	In-Line SWR and Field Strength Meter Measures forward & reflected power by bridge method. SWR 1 1 to 1:3 Imp 52 ohms. Accuracy 5/. indicates transmitter power output strength	$19 00
A-101 Floor Mounting	Kit — clamps around centre hump on the floor. fully adjustable. suits most cars	$6 95

CB Antennae		
CA-60	AM/FM/CB Lock-Down-Centre-loaded with splitter. cables and plugs. one for CB. one for AM/FM	$32.00
CA-70	Magnetic Mount Whip — Centre-loaded coil with 3m. cable & PL-259 plug. heavy ceramic mounting. no installation required	$15 75
CB-100	Roof or Boot Mount Whip — Centre-loaded coil. mount base for roof mount (hole) or boot mount (clamps to edge of boot lid) with cable & plug	$19 95
CB-125	5ft Helical Whip Antennae-stagger wound. best performer. SWR down to 1 1 1 when tuned. with base	$22 00
	12ft lead & PL-259 plug to suit. extra.	$3 00
CB-200	Base Station Ground Plane-ring-rod radiator. 19ft long. high efficiency vertically polarized. omni-directional. aluminium construction in 4 sections. accepts PL-259 plug	$67.00

FAIRMATE 23 CH. $99.50

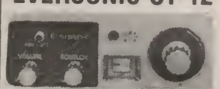


Very compact full facility AM rig, PA, ANL, DELTA TUNE, SQUELCH, S/PWR meter, 23ch. freq. synthesized, only 158mm x 42mm x 192mm deep.

UNIVERSE CB-747 $95.00

Popular model, 23Ch. AM, freq. synthesized, dual conversion, PA, ANL, SQUELCH, DELTA-TUNE, large S/PWR meter.

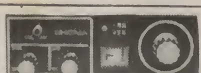
EVERSONIC ST-12



$84.00

Small 23 Ch. AM rig, 3W RF output, with tuning meter, ANL, PA, SQUELCH, dual conversion superheterodyne receiver, sens, 1uV at 6dB S/N, freq. synthesized crystal operation.

SHIGMA 23CH Compact Rig.



Features ANL, PA, SQUELCH, 3W RF output, tuning meter, 3mths guarantee Popular model for beginners.
GREAT VALUE **$89**

DE-LUXE 23 CH. AM.

Our best AM rig — Crystal Phase — Locked Loop system employs only 3 Xtals, offers 0.002 percent tolerance and stability. Features 58 semiconductors, dual conversion receiver, 0.5uV at 10dB S/N, ANL and NB, PA, SQUELCH, large S/PWR meter, Rec and Trans. Indicators, equals or exceeds FCC regulations.
COLT 280 **$124**

HAS YOUR CB CRACKED UP?

Providing parts are available, we can arrange to repair your CB rig at moderate cost. Phone: 747-6472.

"SUPA" SPECIALS

- ☐ 322 MOTOR SPEED CONTROL KIT. Suits most electric motors, 240V 750W max. $4.50
- ☐ 323 TRANSISTOR RADIO REPAIR KIT. Gang, speaker, semis, caps, pots etc. $4.50
- ☐ 324 5" B&W SHARP TV TUBE. New, ideal servicemen, experimenters. $5.95
- ☐ 199 600V 25A SILICON RECTIFIERS. International Rectifier. 10 for $6.50, 25 for $15.00 ea. .75
- ☐ 205 VHF Trans. TV TUNER. Miniature Sharp, 12 channels, 9 with biscuits, new, 2 for $11.00. $6.00 ea.
- ☐ 202 50 ASST. SEMIS. Top grade, tested OK, 15 IC's, 15 trans, 20 diodes, all good, marked etc. $3.00
- ☐ 219 100 ASST. 1W RESISTORS. 5/, 10/ mixed carbon composition. $1.50.
- ☐ 178 ULTRASONIC TRANSDUCER. Experiment at 40 KHz, use as transmitter or receiver, 1" diameterx 1¼" long with lead. $2.95.
- ☐ 179 AUTO NITE-LITE CONTROLLER. Turns on 500W appliances at dark, off at dawn. $8.90.
- ☐ 184 75/300 ohm TV/FM BALUN. Encapsulated, matches 300 ohm lead to 75 ohm, no soldering required. $2.00.
- ☐ 185 AC BATTERY ADAPTOR. 240V AC in, 6V DC 300mA or 9V DC 200mA out. $5.55.
- ☐ 176 TAPE HEAD DEMAGNETIZER. 240V AC, works with all tape heads. $4.00.
- ☐ 173 2 WAY CROSSOVER NETWORK. 5KHz, 30W RMS, 8ohm, 6dB/Oct. $2.50.
- ☐ 174 3 WAY CROSSOVER NETWORK. 2KHx, 7KHz, 40W RMS, 8ohms, 6dB/Oct. $4.50.
- ☐ 325 LIGHT DIMMER KIT. For incandescent lighting, includes RFI noise suppression, with std elect. mtg plate. $5.95.
- ☐ 326 STEREO VU METER. Dual 500uA, lge 1¾" x 1⅜" scales. $6.95.
- ☐ 327 CASSETTE RECORDER MIC. With remote stop-start switch, 200 ohms, one 3.5mm and one 2.5mm plugs. $2.95
- ☐ 328 C60 EXTRA DYNAMIC CASSETTE. Freq. Resp. 20Hz-20KHz, guaranteed. .79c.
- ☐ 329 C90 EXTRA DYNAMIC CASSETTE. High quality tape, fully guaranteed. .99c.
- ☐ 60 CAR STEREO SPEAKERS. De-luxe 130 mm high compliance speakers, black padded vinyl grilles, dual 4,8 ohms, with hook-up wire. $12.00 PR.
- ☐ 214 PLESSEY 24V REED RELAY. Mini encapsulated, PCB mtg, 2pole ON-OFF. $2.00ea.
- ☐ 215 PLESSEY 12V REED RELAY. As above, 3 pole ON-OFF. $2.50.
- ☐ 215 PLESSEY 24V REED RELAY. As above, 3 pole ON-OFF. $2.50.
- ☐ 330 100 ASST. SEMICONDUCTORS Trans. IC's, diodes, all tested, marked. $3.00.
- ☐ 331 30 A 400 PIV SILICON RECTIFIERS. Heavy duty STC RS640 stud mounted. $1.50.
- ☐ 332 CATHODRAY COND. 0.5mfd 2KV. Stud mtg. hi qual, special purpose. $1.00 ea.
- ☐ 249 HP 5082-7300 LED DISPLAY. 7 Segment 4x7 dot matrix, in built decoder-driver and memory, L.H. decimal pt. 0-9 Readout, buy 4 for $26.00. $7.00 ea.
- ☐ 9 'BONANZA' JACKPOT. A 500 gm (approx) lucky-dip offer, all useable parts, samples, specials, end-of-line components incl. semis. $5.00 ea.
- ☐ 333 3 PIN MINI PLUG & SOCKET .60pr.
- ☐ 334 7 PIN MINI PLUG & SOCKET 1.00pr.
- ☐ 335 14 PIN MINI PLUG & SOCKET 1.20pr.
- ☐ 336 37 PIN MINI PLUG & SOCKET 1.80pr.

Electronic Agencies

Trading Hours — 12.00 — 6 pm Mon—Fri. 8.30—1 pm Sat.
Mail Orders — P.O. Box 1005 Burwood North 2134
Post & Pack — Add 15% up to $25 order value. 10% over.
Minimum Order Value — $5.00 C.O.D.'s Send $3.00 pre-paid
Prices & Availability — OK as at 17/3/77

ALL CB RIGS POST FREE

115-117 Parramatta Road, CONCORD, N.S.W. TELEPHONE (02) 747-6472

Write your Name, Address, P/Code here and send your order to P.O. Box 1005, Burwood Nth. 2134.

COME-ON

We Hand The Mic To Our Readers...

The 'True Amateurs', Canberra CB & ACT CREST

Dear Sirs,
Well done! You have presented the Australian public with an unbiased, authoritative, work on CB radio in Australia. Whats more, edited by VKs! Already some VKs I know who have seen "CB Australia" have said 'Renegades, they are not true amateurs', and other assorted things.

To tell you how CB radio is spreading in Canberra I can quote some simple figures. There now exists in the Canberra area three CB radio clubs. They are the "Bravo Whiskey" club more properly known as Belconnen Wireless, in Canberra's northern suburbs, "Sierra Whiskey" club, Struggletown Wireless, being the CB club in Queanbeyan just across the border, and the "Charlie Tango" club, Capital Territory, being Canberra's first and biggest club. In last count the CT club had five new members per day and callsigns in the 640 region had been allocated (as at 15.02.77).

Actually here in Canberra we are very proud about the headway that has been made in organising the CB scene. Already Crest in Canberra operates 24 hours a day, 7 days a week and 365 days a year. It has also assisted in an average one emergency per day since its commencement. Also the ACT police, Fire Brigade and Ambulance all accept any call from a Crest monitor in good faith.

Also a legalisation working party, consisting of local CBers and WIA members, has been formed to bring pressure to bear on the correct authorities.

Every second Tuesday night a club news broadcast is held with callbacks and every Monday night there is a "Committee on the Air" with the club's President and Committee taking any questions asked about local CB events and ideas. It is not uncommon to hear Canberra CBers talking about the WIA news broadcast and Canberra WIA members talking about the CBers news broadcast.

It may be of interest for you to note that since Crest started in Canberra many CBers have been prepared for anything: I carry a small 1 watt unit with 3 channels to work in my brief-case each day (since I travel by bus and not by my private car), so that if on my way to or from work I should come across an emergency situation I can call Crest on Channel 9.

Fortunately I have not had to use it yet, but I have the reassuring knowledge it is there.

Colin
Charlie Tango 142

Roger Harrison

Roger's Reply

Not a **real** amateur, eh! License VB390 was issued to me on 20-1-64, callsign VKZRY. I was issued VKZTB in 1972. First active on 6m with both converted ex-taxi gear and homebrew Tx and Rx. I was an HF and VHF (52,144,288 MHz) listener for some five years prior to that. Over the years I have constructed gear for the bands 52,144, 432,576,1296 MHz and 10 GHz (but no QSOs on last two bands), apart from HF receiving gear. My special interests have been propagation, antennas and circuit

Roger in his VK-zero days . . . Casey, Antarctica.

techniques. I have been President of the Royal Melbourne Institute of Technology Amateur Radio Club and was first President of the RMIT Astronautical Society. I have been a WIA member since 1962. I won first place for VK3 in the Tx Phone section of the 'John Moyle Memorial National Field Day' in 1965 – the first (and only?) Z-call and VHF-only station to do so.

I was a member of the Vic. Div. WICEN for five years and passed through the Government-sponsored signals service course at Mt Macedon Emergency Services School in 1965. I attended callouts to bushfires in Victoria in 1965 and 1967. I have been on the NSW state WICEN committee for the past two years.

During a stay at Casey, Antartica, in 1970 I had extensive experience with mobile and field communications as I spent about six months on a geophysical field survey. While there I operated VK0GR on 7,14 and 21 MHz and established the first (?) 6 metre beacon on Continental Antartica. The Ionospheric Prediction Service subsequently constructed and operated 6m beacons at Casey (VK0GR) and Mawson (VK0MA) from 1972. VK0GR has been heard in southern and eastern Australia on several occasions. I was subsequently involved with the establishment of the VK2WI VHF beacons and an currently the VK2 Div. beacon officer.

I was publicity officer for the VK2 VHF and TV Group during 1972. I operated a 6m beacon from Cocos Is during late 1972, early 1973. In 1973 my wife and I commenced the independent publishing of '6UP MAGAZINE' for VHF enthusiasts. It became well known for its racy, controversial style, good technical articles and news. We initiated a 'State of the Art' contest to foster the more difficult modes and techniques.

I have been writing articles on amateur radio since 1964 and have twice won the 'Best Technical Article' aware from the WIA journal 'Amateur Radio'. First, for a series on Transistor Amplifier Design and then for a two-part article on 'Transequatorial Propagation' – the last was reprinted in the English and foreign language editions of the prestigious international journal 'VHF Communications' published in Germany. A short version also appeared in ETI. I have also had articles published in Ham Radio, 73 Magazine and Break-In (NZART Journal), as well as local club newsletters – apart from numerous ones in ETI, which you've all seen, no doubt.

R.H.

Steve Braidwood

Who're the True Amateurs?

Who's not a true amateur? In my view it is the VKs who oppose the legalisation of CB that are the renegades. They appear to renounce the altruistic principles of amateur radio only to protect their selfish ends. And I'd be one of them if this really was the case – if it really meant opposing a threat to amateur radio as a hobby. But legalising CB is not going to impinge on the freedom of the radio amateur. No, I believe it is not self-interest which makes some VKs anti-CB, it is simply bloody-mindedness. Like the child who suddenly becomes possessive about the toy that's been forgotten for months, just because his brother wants to play with it, so certain VKs feel that, simply because they are the only people who currently have legal rights to use radio transmitters for hobby purposes, no other people should be granted these rights in the future.

Could they be frightened that in future no-one will become a radio amateur because of the soft-option CB licence? If this is how they feel then they themselves are not true radio amateurs, presumably they are bitter because in the past they have had to pose as radio-experimenters (and force themselves to learn the technicalities of radio) because under current laws this pretence is the only legal outlet for the desire to communicate by radio (a desire equally common among the technical and non-technical public).

If I am right then these VKs have some cause to be bitter. But it is the system which denied them CB that they should be angry with. Imagine their plight when they first discovered the pleasure of radio communication – listening in on amateur QSOs, dying to go back to that unanswered CQ. And think of the struggle it must have been for them to learn the technicalities of radio (not necessarily out of genuine interest, but as a means to an end). The desire to communicate driving them on when others fall by the wayside.

But in a world where people are taking up their rights without having to buy or earn them, those people who have invested in old values are bound to get hurt in the course of social progress.

S.B.

Note: *We have found that there are very few radio amateurs who actively oppose the legalisation of CB. Despite the antagonistic view of the WIA, most of the amateurs we know are in favour of CB.*

My amateur radio background is not as impressive as Roger's, but for those who doubt my authenticity here goes: Call-sign G3WKE was granted to me ten years ago in England and my activities were largely on the HF bands. VK2BSY was issued after I was transferred from the UK edition of ETI to the parent edition in Australia. When I get time I operate on 2m and, of course, on 27 MHz.

US Channels 23,24 & 25 – The Correct Frequencies

Dear Sirs,

I feel the first issue of CB Australia was an excellent effort on your part.

At the moment, because of the relative "newness" of CB many people buying CB gear have been ripped off. Two examples that come to mind are:

(1) A friend of mine was charged $50 installation fee on his Weston 5W transceiver.

(2) I was recently in a shop where a salesman said "Six channels is enough to start off with. It's cheaper than a 23 channel one."

The thing is the rig was $90 and crystals at $7.95 a pair (CB frequencies, not fishing club) which would have cost $138. The "23 channel one" he was talking about cost $110.

There is one mistake you have made on page 19 of CB Australia. The frequency allocations for the 40 channels are correct however three of the channel numbers are wrong. According to the FCC the list should read:

Frequency	*Channel*
27.225	*22*
27.235	*24*
27.245	*25*
27.255	*23*

Channel 23 remains 27.255 MHz to avoid confusion on QSO's between a 40 channel transceiver and a 23 channel transceiver.

Paul Fuller

KEEP IN TOUCH!

with world famous REALISTIC transceivers

REALISTIC TRC-99C (21-133)
3 WATTS INPUT, 3 CHANNELS

REALISTIC: TC-101B (21-129)
5 WATTS INPUT, 23* CHANNELS

Realistic TRC-99C A sensitive receiver with automatic noise limiter and gain control for pulling in clean and steady signals. Plus squelch control and jacks for external speaker, mike and antenna also battery charger and DC power. With crystals for 1 channel and 10AA batteries. **59.95 each.**

Realistic TRC-101B the features of many base stations but you hold it in your hand. It's fitted with crystals for all 23 channels plus sensitive condenser microphone and battery saving Hi-Low power switch. 3 way signal strength/RF output/Battery meter, fine tune switch, and jacks for accessories. Complete with 8 AA Batteries. **109.95 each.**

REALISTIC TRC-68 (21-168)
4 WATTS OUTPUT, 23 CHANNELS

REALISTIC TRC-11 (21-141)
5 WATTS INPUT, 6 CHANNELS

REALISTIC TRC-124 (21-245)
5 WATT INPUT, 23 CHANNELS

Realistic TRC-68 – a great buy. Comes complete with crystals for all 23 channels, push to talk mike, squelch control, full time ANL and all mounting hardware. **109.95 each.**

Realistic TRC-11 Don't let its size fool you. It has a full 5 watts input power: Ideal for maritime safety frequency or you can mount it in your car. With squelch control and switchable ANL. Complete with mike, crystals for one channel, power cables and mounting hardware. **89.95.**

Also available with maritime safety frequency crystals fitted as 21-141F

Realistic TRC-124 State-of-the-art circuitry with innovative phase lock loop frequency system plus bright LED digital channel indicator. Also has large RF/S meter, PA facility, Push button noise blanker, delta tune and squelch. Ready to go on 23 channels with mike and mounting hardware. **169.95.**

*Note: Channel 23 is outside the Australian Amateur Band.
Users of Walkie Talkie/CB equipment require a P.M.G. novice or amateur licence.

Realistic is exclusive to

TANDY ELECTRONICS

with 108 stores in Australia.

Or you can order by mail. Write to
Mail Order Dept.,
Tandy Electronics,
280-316 Victoria Rd.
Rydalmere,
N.S.W., 2116.

CB ACCESSORIES

Roger Harrison looks at the accessories now on sale to help you achieve the best installation and performance from your CB station. See the advertisements in this issue for details of suppliers.

Accessories for CB installations can be broken down into about four categories:

(a) **Antenna Accessories** such as connectors, patch cables coax switches, couplers, filters, etc.

(b) **Receiver Accessories** such as RF amplifiers, hash filters, converters, remote speakers, etc.

(c) **Transmitter Accessories** such as SWR meters, power meters, field strength meters, dummy loads, etc.

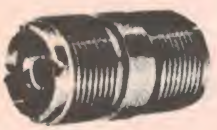
(d) **Operator Accessories** such as headphone/mic combinations, mic holders, transceiver mounts, power supplies, test sets and accessory operators(!) etc.

Accessories are items that are not necessarily essential for an installation but are usually convenient additions, or they extend the operating convenience, or they allow checking of the equipment performance, etc. It's possible to spend more on accessories than you paid for your transceiver!

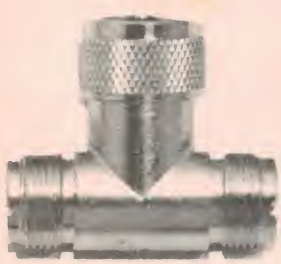
Exactly what you get in accessories depends greatly on individual circumstances. You may have to get some accessories because you find they are necessary — a low pass filter, for example, to prevent TVI (or help anyway). Some accessories are simply 'dressing' and could never be envisaged as 'necessary', while others simply improve the convenience of an installation.

Whatever your excuse, or perhaps your need, browse through the survey and you'll get an idea of what's around.

Right angle adaptors. Just the thing for 'dressing' coax in convenient directions or where space is limited behind a rig. Cost around \$2.20-\$3. Available most outlets.



Double-female adaptor. Generally used as a cable joiner. Useful where a cable needs to be 'broken' to permit the insertion of an SWR/Power meter or other, not permanently installed, accessories. Cost around \$1.20-\$1.80. Available most outlets.



'T'-connector. Often used with co-phased antenna installations. Can be used as cable-joiner in emergencies. Cost \$2.50-\$3.50. Available most outlets.

"UHF" to "RCA" adaptor. Standard RCA plug with standard ("UHF" series) SO-239 socket on back. Useful on accessories fitted with RCA sockets. Standard PL-259 plug fits into SO-239 socket. Cost around \$1.60.

Fig. 1. Common connectors/adaptors.

Antenna Accessories

The simplest of antenna accessories are probably the humble connectors. Apart from the common-or-garden-variety PL-259 plug which you have no doubt already met, there are a whole host plug/socket 'adaptors' (as they are called). These are useful in situations that suggest themselves when you don't have them on hand. I tell you — Murphy and his crazy laws sure get around!! There you are, you've just put the finishing touches to installing the transceiver in your new car — it fits great. Now just plug the antenna in and give it a burl . . . but the connector won't go in the socket — their isn't enough clearance at the back of the set (even if the set is removed and the antenna plugged in before mounting the transceiver). Call Murphy the magic word. And then get a 'right angle adaptor', put that on the transceiver antenna socket first — the antenna can then be plugged in from below. A right angle adaptor is simply a PL-259 plug, a right angle bend and then an SO-239 socket. Handy, no?

The common connectors/adaptors are illustrated in Figure 1. It is wise to keep a selection on hand. Most are quite cheap, less than \$3 generally, so

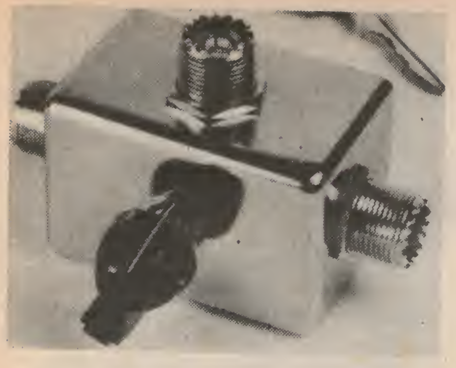


Fig. 2. Typical coaxial switches of the single-pole, two-way variety. Prices vary, but expect to pay around $20 or more.

it won't break the bank to stock up.

Coaxial switches are often used in base station installations so that the operator can select different antennas, or perhaps switch between an antenna and dummy load/power meter to check transmitter performance. Alternatively, it may be used to switch an antenna between several transceivers or between a transceiver and a monitor or scanning receiver.

Coaxial switches are available in several combinations. Perhaps the most common, and certainly the least expensive, are the single-pole, two-way (or two-position) variety. Several are illustrated in Figure 2. Some types come with a rotary switch, some with a slide switch. A rotary, single-pole, two-way coax switch will set you back around $20. A slide switch of the same variety will cost around $12. A single-pole, three-way rotary switch will cost almost $30, (there are some cheaper ones however, around $10 mark) maybe more in some places, while a five-way rotary style will cost around $32-$35. But that's getting a bit extravagant — what would you do with all those five sockets? . . . . Don't tell me, I can imagine!

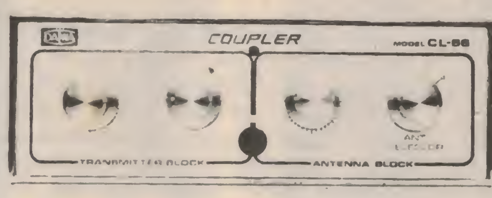
What do you do when your antenna won't match? Why, you get a matchbox of course!! Now, there are a whole raft of devices on the market that will purportedly match a cranky transceiver to anything you can conjure up. Well, not quite perhaps, but you get my drift. They can be useful. For installations where there is not a long feedline run to the antenna, these devices can be quite useful where the antenna either refuses to be matched and produce an SWR within reason (see last month), or where the antenna has no provision for adjustment.

These device go under a whole variety of names such as 'matchers' (not the red-headed variety that your-old-man-told-you-to-trust-in-that-crazy-TV-advertisement); 'couplers' (and that's not what you think); 'antenna eliminator' (I know it's crazy but it really says that!) and the ubiquitious 'black box'.

Basically, they consist of circuitry that adjusts the antenna-feedline system for optimum resonance and matching to the correct impedance (50 ohms) to suit the transceiver. Some types may include an SWR/power meter for convenience. Various different types are illustrated in Figure 3. The simpler types sell for around $12 to $15, up to $20 or so. If you really want to go to town, you can pay more for a coupler than for a transceiver (people do!?!) — as the Daiwa models from VICOM in Figure 3 show. These types would be more use to amateurs, though.

The 'antenna eliminator' type is really a matching and tuning system for standard car radio antennas. They permit the car radio and transceiver to be connected to the antenna simultaneously. Internal circuitry disconnects the car radio from the circuit when you go to transmit. Some types are simply a 'black box' without adjustments (such as the 'CB blackbox' from Peter Shalley) and these are preset. Other types (such as the 'Antenna eliminator' from Dick Smith) include a knob to allow adjustment of the tuning for best SWR. Sounds alright — but tempting for the inevitable 'knob twiddler' — mount this type out of their way. The Antenna Eliminator from Dick Smith

The simpler type of antenna matching devices generally include two controls: 'tune' and 'load' to effect correct resonance and matching of the antenna and feedline system. They cost around $12-$15. This model 140 matcher from CONTACT is $15.



Somewhat more sophisticated is this Model CL-66 coupler by Daiwa. It is claimed to cover 3.5 MHz to 29 MHz and to match 10 through 600 ohms (unbalanced) to 50-70 ohms. It includes a four position coax switch and costs around $120.

This deluxe model, also by Daiwa, includes an SWR and power meter. It also covers similar ranges as the CL-66 and sells for $175. More useful for amateurs really.

The 'antenna eliminator'; similar units referred to as 'black box', for obvious reasons. These allow you to use a standard car radio antenna for CB. They permit both the transceiver and the car radio to be plugged in at the same time. The car radio is disconnected by the internal circuitry when you go to transmit. Some provide a tuning knob to obtain best match (low SWR) while others are pre-set. Cost depends on type and supplier; varies between $25 to $35.

Fig. 3. A variety of antenna matching or coupling devices.

Fig. 4. A typical patch cable consisting of a short length of RG58 coax with PL-259 connectors on each end. Useful for patch connections to SWR meters, filters, couplers and other accessories. Obtainable in 0-5 m, 0-6 m and 1 m lengths. Cost depends on length – generally $2-$3.

An 'adaptor' lead, usually used for antenna installation. Usually in lengths of 3 m or 4 m. Cost around $3.

A cable and connector set. These usually include a 3 m or 4 m length of RG58 coax, two PL-259 connectors and several spade lugs. Useful for feedline extension cables or antenna installation. Cost around $4-$5.

Fig. 5. Cable accessories suitable for various feedline applications.

costs under $30 at present while the CB Blackbox from Peter Shalley is $35.

There are a number of other antenna couplers about but they are generally for the amateur market and their operating features, etc, are geared that way. However, that does not mean to say that they are unsuitable for CB applications.

One advantage that goes along with the use of a coupler (except perhaps for the antenna eliminator variety) is the reduction of harmonics from the transmitter (weak transmissions from the transmitter at 2,3,4, etc, times the actual transmit frequency, generated in the transmitter circuitry). Harmonics can cause TVI. The very nature of the tuned circuits generally employed in couplers/matchers effects the reduction.

If you don't use a coupler or matching device, or even if you do, it is a wise precaution to fit a 'low pass filter' in the feedline. This, as its name implies passes all frequencies below a given 'cutoff' frequency, usually around 34-36 MHz. It attenuates (severely reduces) any signals or transmissions above the cutoff frequency. Harmonics from 27 MHz transmissions fall at 54 MHz (near channel 1 TV), 81 MHz (in low-band VHF land mobile service), and 108 MHz (top end of FM band); these would probably be the strongest (2nd, 3rd and 4th harmonics). Some sets are worse than others regarding the radiation of harmonics.

Low pass filters should be installed close to the set with as short a length of feedline between the transceiver and the filter as possible. A low pass filter will set you back anything from less than $10 to more than $30. If you have a good quality transceiver ('top of the line', particularly an SSB transceiver) then one of the less expensive filters will probably be sufficient as the more expensive transceivers generally have lower harmonic output than the economy transceivers. For the latter, one of the more expensive filters, which provides higher degree of attenuation to harmonics, is a safer bet. Funny that, isn't it!

Now, to plug all your accessories in the feedline to the antenna you're going to need a short length of cable with two PL-259 plugs on each end – a 'patch' cable. These are quite inexpensive and can be obtained in a variety of lengths, generally 0.5m, 0.6m and 1m. Cost depends on length and varies from distributor to distributor – generally around $2-$3.

Apart from patch cables, 'adaptor' leads and cable/connector sets are available. An adaptor lead consists of a length of RG58 coax with a PL-259 connector on one end and a set of spade lugs attached to the inner conductor and braid at the other end. They are obtainable in lengths of about 3 m or 4 m for around $3. They are often used for installing antennas, particularly those that comes without a cable.

A cable and connector set generally consists of a 3 m or 4 m length of RG58, a pair of PL-259 connectors (usually the solderless or crimp-on type), and a set of spade lugs. They come in handy when installing antennas as they can be made up in the same manner as an adaptor cable. They are also useful as a feedline extension cable, using double-female connectors to 'splice' in the extension.

Before leaving antenna accessories, I guess one should mention coaxial lightning arrestors. These are inserted in the feedline to prevent damage to the transceiver etc during electrical storms when high voltages are induced on antennas – this situation is usually worse with base station antennas as they are generally mounted much higher than mobile or marine antennas. Even if lightning does not strike nearby, quite high voltage may build up on the antenna. If they discharge through the transceiver's receiver input circuitry then it may be damaged. The lightning arrestor will cause these high voltages to be passed to earth without harm to the transceiver – if installed according to instructions. They will not protect against a direct strike.

A coaxial lightning arrestor will cost you about $10. They aren't available everywhere though. You might have to hunt around a bit. Bail Electronics Services have one, a model LA-72, for $9.50.

Receiver Accessories

To improve receiver performance an RF amplifier may be connected in the antenna lead to boost the strength of the signals. These are useful where only an inefficient antenna system can be used, which affects receiver performance. Unfortunately, while you can 'hot-up' the receiver like this and hear all those signals you couldn't copy previously, transmitting efficiency is still poor.

The 'RF Signalizer' model Rp-10, which is available from Dick Smith and MS Components (at least) is a typical device for these sort of applications. It includes a very handy 'RF Gain' control that allows the operator to vary the sensitivity of the unit over a range from full gain of 15 dB (amplification of about 30) to an attenuation of 20 dB (attenuation of 100). This permits you to adjust for maximum gain on weak

Listen to the CB bands on your car radio. Receives 26.535 – 26.610 MHz, converts it to normal AM band. Extremely simple installation; can also be used with other radios with correct fittings. 12V DC.

Fig. 6. A CB converter. This model comes from Dick Smith for $33.

Fig. 7. Typical remote speakers. The one on the left is best suited to cars whereas the horn speaker on the right is weatherproof and best suited to boats. Cost, around $9-$10.

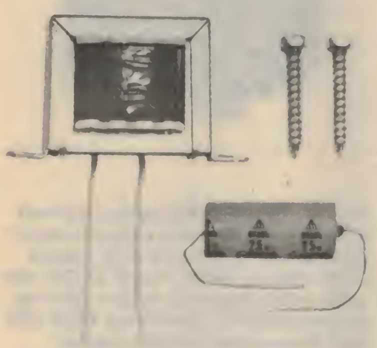


Fig. 8. 'Hot Line Filter' components to reduce ignition system and alternator noise in transceivers etc. Cost around $3.

signals and lets you reduce the gain for strong local signals that would normally overload the receiver in your rig. Dig in for around $40 to $48 for this little accessory — depending on where you shop.

A popular 'accessory', if it could be classed as such, is a CB converter. Intended for mobile operation, these convert CB band signals down to the broadcast band range so that you can hear them in a clear spot on your car radio. It makes use of the existing car radio antenna and connects into the antenna feedline between the antenna and car radio. A front panel switch is included to switch it out and the car radio to normal operation. They cost $33 to $35 depending on where you shop. Even less on special!

A remote speaker can improve intelligibility of received signals (but not the intelligence of the other operator, more's the pity too often!) as the loudspeakers used in most CB rigs are quite small. In addition, the rig's speaker is often obscured somewhat (depending on the mounting position of the transceiver) and the actual sound output is restricted. A remote speaker can make quite a difference. Figure 7 shows two typical remote speakers. The square one is best suited to installation in a car and can be mounted either under a dash or on top of it — or any other convenient place. Remote speakers are also very handy in base station installations. The horn speaker is weatherproof and ideal for mounting in a boat installation. Make sure you get a weatherproof type and not a 'weather-resistant' type (unless it can be mounted in a sheltered position). Either type cost around $9-$10.

Getting rid of hash generated by a vehicle's electrical system was generally covered in 'Installing a Transceiver in Your Car' (CBA Vol 1, No 1). However, even if the ignition system is fitted with suppression components along the lines set out, it is sometimes found that interference still gets through. Often it is conducted via the battery connections to the transceiver. Such cases call for a 'hot line filter'. It consists simply of an iron-cored inductance and a large value capacitor. It is connected in the 'hot' lead (i.e: the un-earthed lead) from the transceiver to the vehicle battery. The sort of components supplied are illustrated in Figure 8 and they should be connected in accordance with the instructions supplied. In addition to reducing ignition system noise conducted via the power lead these devices also reduce alternator/generator hash that is often conducted along the same path. A hot line filter will cost you about $3. As they are usually constructed to operate on currents up to 20A, one filter can be used for several appliances.

Alternators and generators produce electrical noise that can be troublesome to eliminate and can severely interfere with clear reception — even on strong signals. This sort of noise sometimes appears on transmission as well! A coaxial capacitor, such as the one illustrated in Figure 9 is best for eliminating alternator whine and other noises. It should be installed as close as possible to the 'hot' output terminal of the alternator using as short a lead as possible. Some vehicle accessory shops carry these components.

Cars fitted with generators need a different sort of filter to reduce the electrical noise produced by the generator brushes — which can be quite considerable.

The generator filter illustrated in Figure 10 is a broadly tuned circuit that can be optimised to provide maximum noise reduction over a small band between 3 MHz and 30 MHz. It is suitable for any vehicle electrical system from 6 V to 24 V. It needs to be mounted as close as possible to the 'hot' output lead of the generator and connected with a short lead to the

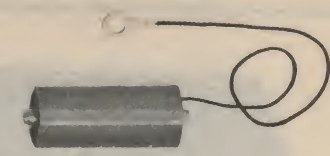


Fig. 9. A coaxial capacitor suitable for suppressing alternator whine and other noises. It is installed as close as possible to the 'hot' output terminal of the alternator.

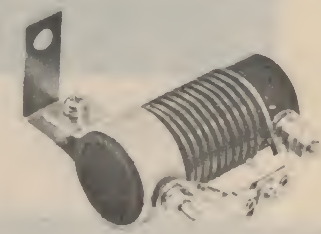


Fig. 10. A generator hash suppressor. It should be installed close to the generator and connected in series with the 'hot' lead from the generator. The trimmer is tuned to minimise hash in the receiver.

generator terminal. With the receiver on and the engine running somewhat above idle, the trimmer is adjusted to minimise any generator noise in the receiver.

Transmitter Accessories

The most common instrument used to check transmitter and antenna performance is the SWR meters is illustrated in Figure 11. Those types having a single meter are fitted with a 'Forward-Reverse' switch. The dual meter types have one meter to measure forward energy and one to measure reflected energy, in order to obtain the standing wave ratio. All types have a 'sensitivity' control.

To measure SWR, the 'Forward-Reverse' switch (where it is incorporated) should be switched to 'Forward'. The sensitivity is then adjusted, whilst transmitting, to give full scale deflection (or full scale deflection on the 'Forward' power meter for dual-meter types). Then switch to 'Reverse' while still transmitting and read the standing wave ratio, or read the SWR scale on the dual-meter type.

Many SWR meters have small switches on the back marked '50' and '75', or something similar. These should normally be switched to '50' as they set the instrument to measure correctly the SWR in a 50 ohm transmission line. Those that do not incorporate these switches are generally made for 50 ohm systems.

An SWR meter can be left permanently installed, if convenient, so that the performance of the transmitter and antenna system may be constantly monitored.

Fig. 11. Typical SWR meters. Various types and models have only one meter (such as the Kyoritsu K-109, Handic SWR, Calcom 9856, Tandy 21-525 etc) while others have two meters (such as the Handic SP-1, Oskerblock SWR-200 etc). Some types include a power measurement scale (like the Handic SP-1 or Oskerblock SWR-200) whole others, usually the small inexpensive types, incorporate a field strength meter (like the Calcom 9856 or Handic SWR). Operation is explained in the text.

The simple style, combined SWR and field strength meter, cost between \$12 and \$18. The single meter SWR meters vary in price from about \$18 to \$25. The dual-meter, combination power and SWR meters cost anything from \$27 right up to about \$90 and more.

The power measurement facility on many SWR meters is very handy, but an accurate reading can only be obtained when the transmitter is connected to a dummy load via the SWR/power meter (unless the SWR is fairly low, say 1.5:1, or less). It is best to get one that has a 5 W or a 10 W scale. Trying to read 3 W or 4 W on a 20 W or 50 W scale is somewhat difficult, as you may appreciate.

Field Strength meters are useful for checking that an antenna is really radiating and they allow comparisons to be made between antennas operated under similar conditions. You can also get a rough idea of the radiation pattern of your mobile antenna. Park your car in a large, open paddock and, maintaining a constant distance from the vehicle, walk around it in a circle noting relative signal strength readings at a number of points. This can then be plotted up on a graph. The field strength meter sensitivity should be set at some arbitrary point first, by trial and error if necessary, and then not touched. We might explain how to go about this in more detail in a later article.

A very handy accessory when checking a transceiver's performance is a 'dummy load'. It is simply a small power resistor of 50 ohms mounted in a PL-259 fitting. Some types add a small light that turns on when you transmit and which flickers to indicate modulation when you talk. On SSB, it will only light up when you talk – or something is very wrong! They are quite inexpensive, costing around \$2.50 to \$3.

The advantage of a dummy load is that it provides a load of correct impedance (no standing waves) and does not radiate (or pick up signals!) while tests are being conducted.

Operator Accessories

About the most useful operator accessory is an accessory operator! Capital outlay is virtually nil but upkeep and maintenance costs may stretch the budget on occasions. They are readily available – you don't even have to go down to your local CB shop to get one. The choice is yours.

A useful accessory in high noise situations, such as mobile, is a combination headphone/mic. A typical example is illustrated in Figure 12. It consists of a single headphone (you're got to hear what is going on around you), a microphone on a short boom, positioned to one side of your mouth and an in-line push-to-talk switch that can be clipped to your clothing. This feature is convenient as you don't have to reach for the usual push-button mic. The earphone blocks out external noises to give you clearer reception and the mic can be located for best voice pick up and least background noise pick up. Very

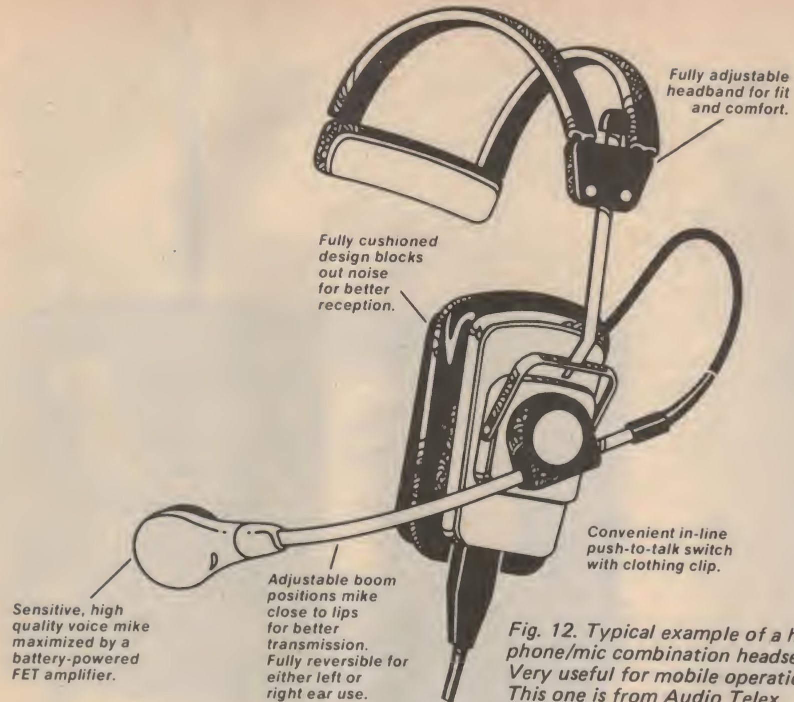


Fig. 12. Typical example of a headphone/mic combination headset. Very useful for mobile operation. This one is from Audio Telex Communications.

useful in multiple-operator situations where transceivers are located near other transceivers, telephones, etc.

Keep losing your mic because it falls on the floor from the seat beside you when you go around corners? Well get a mic holder and attach it to a convenient spot on the dash in front of you. Then the mic is within easy reach all the time.

There are two basic types available – the screw-on type and the magnetic type. Both are self-explanatory. Either costs less than a dollar, so there's no excuse.

Having a transceiver permanently mounted in a boat or vehicle can be both an inconvenience and a risk. It is inconvenient to remove it if you want to use the equipment elsewhere and it is vulnerable to burglary.

The solution is to mount the transceiver on a 'lock-in' mount that is permanently bolted to the vehicle or boat but allows the transceiver to be installed or removed easily for storage (out of harm's way) or for transporting the equipment to another place. For what they are, they're quite inexpensive, costing around $5 to under $10.

Most CB transceivers are designed to operate from a nominal 12 V supply, specifically a vehicle battery. However, if you want to use your mobile as a base station a suitable supply is necessary. Sure, you can keep a car battery under the kitchen table but they are bulky, heavy and somewhat of a nuisance in that situation. And how are you going to keep it charged?

Power supplies that deliver a fixed output at around 12 V, or variable ones that can be set to the required voltage are suitable to power a mobile transceiver for a base station installation. It should be capable of delivering 3 A to 5 A, certainly no less than 2 A, if adequate performance is to be obtained.

Suitable power supplies are available that deliver a regulated fixed 12 V or so, or have a variable output, regulated, that can be varied between 0 V and 15 V. The fixed voltage types generally sell

Continued on page 18 . . .

Fig. 13. One type of transceiver mount that allows the transceiver to be locked in and out of the mount easily for storage or portability away from a boat or car.

Manufacturer's Specifications Handic FS117 CB Tester

Makes it possible to carry out checks of stations working in the 27 MHz frequency-band. Portable.

Range of work:

1. Power meter 0—5 Watt ±10 %
2. Standing wave ratio (SWR) 1:1—1:3. Min. 1 Watt
3. Modulation meter 0—100 % ±10 %. Min. 1 Watt
4. Relative field strength
5. 27 MHz signal generator. Output: 300 mV min. no load.
6. Crystal condition test (bad or good indication)
7. 27 MHz signal generator with tone modulation, 1000 Hz
8. Tone frequency generator. 1000 Hz. Output: 1 V min. no load
9. 5 W dummy load

Data:

Frequency: 27 MHz
Impedance: 50—52 ohm
Connectors: HN-210 (coaxial connectors)
Measuring instrument: 100 μA
Power: 9 V (battery)
Size: 180 x 120 x 80 mm (W x H x D)
Weight: 0,8 kg

Fig. 14. The 'Universal' test set marketed by Handic, available from Peter Shalley and M& K Communications. These sort of instruments cost around $45-$55, the specification above indicating the various tests that can be performed.

for a little less than $30 while the variable supplies are priced at around $40.

For the man who has not quite everything, there is the 'universal' test set. The Handic FS-117 instrument, illustrated in Figure 14, is typical of this sort of 'accessory' (?). As can be seen from the specification, a wide variety of functions and checks can be carried out using one of these. The Handic FS-117 is available from both Peter Shalley and M & K Communications. Bail Electronics Services also carry a universal test set, type RS-107, listed at $57.

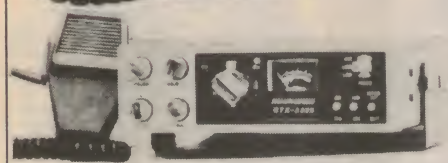
Apart from the main sorts of accessories detailed in this article, other accessory components such as microphone, plugs and sockets, microphone 'curly' cords, in-line fuse holders, etc, etc, can be obtained from many outlets if you happen to need a replacement component for one of these items or if you wish to change one.

GEMTRONICS CB Transceivers from BAIL

novice, CB and marine

GTX-3323

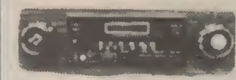
Delux AM 23 Channel transceiver featuring built-in range boost modulation, switchable Automatic Noise Limiter, Modulation indicator and front panel CB/PA switch.
$89



GTX-3325

Delux SSB/AM 23 channel transceiver featuring built-in Range Boost Modulation, FET RF amplifier for high receiver sensitivity, Noise Blanker, RF gain control and large S-meter. 15 watts PEP SSB, 5 watts AM.
$279

also available from BAIL ELECTRONICS



606CB

The Ultimate Communications/ Entertainment Centre.
In-Dash combination, AM 23 channel 27MHz 5 watt transceiver/AM BC receiver/FM MPx receiver/stereo cassette player. Switch on the 606CB's unique Stand-By control while you play your favourite cassettes or listen to regular AM or FM Stereo broadcasts. The 606CB will then monitor 27 MHz for you, interupt your programme for 27 MHz transmissions, and resume programme play afterwards.
$368

CBR9000

In-Dash mounted 6 channel 27MHz 5 watt transceiver/AM broadcast/FM broadcast plus scanning. Features Tx, Scan and Rx indicators. Scan control allowing the set to monitor 27MHz channel while you are listening to your favourite programme
$184

Also available from BAILS — a large range of Antennas and Accessories. Above prices include S.T. Freight and Insurance is extra. 90 day warranty. Prices and specifications subject to change.

Note all transmitting Equipment Requires a Licence

bail ELECTRONIC SERVICES

60 Shannon St., Box Hill North, Vic., 3129. Phone 89 2213
Distributors in all states and N.T.

JAS677—19

IN STOCK NOW!

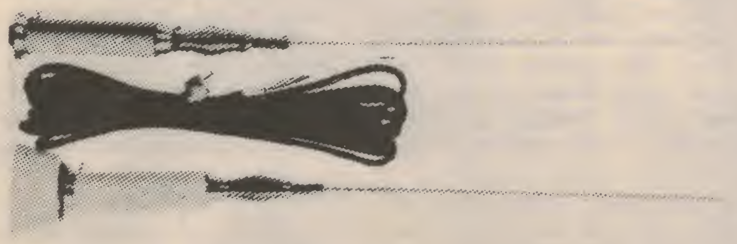
IBETA 23-Channel AM Mobile Citizensband Transceiver

STILL AT THE PRE-DEVALUATION PRICE OF

$89 + P&P $5.00 (NORMALLY $139.00)

SPECIFICATIONS

1. **Semiconductors:** 19 Transistors and 15 Diodes
2. **Frequency Range:** 26.965MHz-27.255MHz
3. **Mode of Operation:** AM
4. **Controls:** Volume Control with Power On-Off Switch • Variable RF Gain Control • Variable Squelch Control • Delta Tune Switch • Channel Selector Switch • CB-PA Switch • ANL Switch
5. **Connectors and Jacks:** Microphone Connector • Coaxial Type Antenna Connector • Public Address Speaker Jack 3.5mm • External Speaker Jack 3.5mm
6. **Speaker:** 3½ inches, 8 ohms
7. **Microphone:** Dynamic Microphone (500 ohms)
8. **Power Supply:** 13.8 VDC Positive or Negative Ground



Also in Stock

Mobile Antenna to suit Ibeta CB Transceiver **$15** plus p&p **$2.**

Overall length: 47"
Cable: 17 feet RG-58U (52 ohms) coaxial cable w/PL-259 Connector
Mounting: a. Trunk Mounting b. Rooftop Mounting.

TRADE ENQUIRIES WELCOME

Call, write or phone to: **C. H. S. TAYLOR'S WAREHOUSE SALES**
169 JOHNSTON STREET, COLLINGWOOD. VIC. 3066 PHONE: 419 3862

CB CLUBS

Since the influx of cheap CB gear many clubs have been started to coordinate the efforts of those citizens who want to be able to use their equipment legally. But the clubs are not just political pressure-groups: some organise social events and provide ways for new members to learn more about citizens' radio.

Here Stephen Wagstaff, president of what is claimed to be the largest of these clubs, writes about what the clubs have to offer to the enthusiast.

THE ADVENT AND growth of CB radio in this country has attracted a lot of citizens from various walks of life. These citizens, their numbers vary from 12,000 to 15,000 (government sources) to the staggering sum of 250,000 (CB sources) all have a common problem in that many of their members are running against the present laws of the land. The law (Sec. 61A of the Commonwealth Act No. 8) has as its maximum penalty 5 years hard labour or $1,000 fine.

The situation. in which these people are under threat of legal charges for what they think is a harmless hobby, has resulted in many of these individuals forming organisations and clubs to give themselves solidarity and support in their quest for legality.

Some of these clubs provide financial assistance for any of their members who are unlucky enough to be charged. And of course it is a good feeling to know that you have the close support of your club when faced with various charges under the Act.

When all the clubs joined together in November last year to participate in "The Great CB Convoy Rally" the public was made aware for the first time that a large number of citizens from all walks of life were involved in CB.

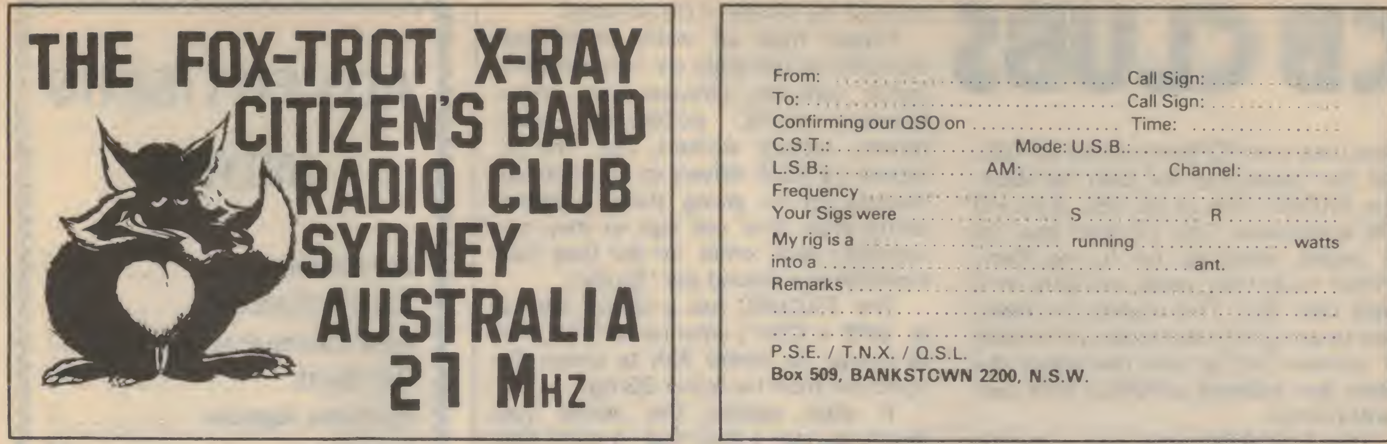
Clubs also make it easier when you are putting your case to police or various government departments. Who takes notice of one individual? Not too many people. But they can't turn a deaf ear to the voices of hundreds and even thousands.

Clubs have been formed for many reasons. The most common one is the coming together of large numbers of people who are interested in legally operating transceivers on the 11 metre band.

Most clubs have electronics experts amongst their members. Most of these people are only too interested to go out of their way to help the other club members who need technical help.

The FX CB Club

In Sydney FX club has various printed sheets which are distributed to the members. These sheets have radio codes, the phonetic alphabet, the list of



THE FOX-TROT X-RAY CITIZEN'S BAND RADIO CLUB SYDNEY AUSTRALIA 21 MHZ

From: .... Call Sign: ....
To: .... Call Sign: ....
Confirming our QSO on .... Time: ....
C.S.T.: .... Mode: U.S.B.: ....
L.S.B.: .... AM: .... Channel: ....
Frequency ....
Your Sigs were .... S .... R ....
My rig is a .... running .... watts
into a .... ant.
Remarks ....

P.S.E. / T.N.X. / Q.S.L.
Box 509, BANKSTCWN 2200, N.S.W.

This is the QSL card used by pirate operators who are members of the club. This one looks a bit too like an amateur QSL card, surely the recipient would be more interested in twenty (base or mobile) than in which sideband was being used. But it's a start — no doubt the legalisation of hobby CB would mean more personal details (such as home address) could be exchanged.

frequencies and other necessary information to help the newcomer in adapting to his pastime.

To help the CB community as a whole the clubs have their own clean air rules (CAR). If their members follow them their relationships with other CBers will be cordial and relaxed.

Most of the clubs have versions of the CAR rules similar to those of the FX club. The FX Clean Air Rules are as follows:

1. The home channel is Ch7 (27.035 MHz). This channel is used solely for club contact. Members are requested to QSY (leave the channel) after 30 seconds.
2. Do not QSO (talk) on channels 7, 14 and 11 and 9 (this last channel is set up as an emergency channel).
3. Recognise breakers at the first possible opportunity, and ask them to standby if you are busy in conversation.
4. If you want to join in on the conversation wait until there is a break in the transmission. then say breaker, give your call sign, and say standing by.
5. At all times use your own call sign and handle while talking to other stations.
6. Keep a reasonable distance (ie, 50 metres) from all television transmitters, radio stations, and private houses to minimise interference.
7. Club members shall not transmit while under the influence of alcohol to the point whereby they cannot operate their rios to the club standards.
8. No swearing or heavy slang words are permitted on air.
9. No whistling or playing music or any other interfering with QSOs is permitted.
10. There is a complete and total ban on giving out on air other people's telephone Nos., Home 10-20s (addresses), vehicle descriptions, etc, unless you have that person's permission (preferably in writing).

NB: Any serious breach of these rules will result in a fine determined by the club committee.

Looking at these you will see that the clubs are trying to promote a responsible set of standards for their members to follow. If these standards are followed the club and members will, in their own right, be an asset to the community.

The FX club was the first full-time club to hold regular meetings of its members where they could meet each other and swap ideas. It reflects the new attitude to CB whereby CBers are not criminals but people who want to help each other. The days are gone when people were afraid to go on eyeballs and meet each other for fear of being caught by the law enforcement agencies.

Club Organisation

Most clubs are non-profit prganisations whereby all money collected from members is put back into the club or into the battle to get CB legalised.

The FX club has various pieces of equipment available for members' use. Such equipment includes aerials, SWR meters and power meters. It also has a small library of magazines and technical books which members can use to gain information to build various accessories for their hobby.

The FX club also invites special guest speakers to meetings to instruct the clubs on subjects related to CB. Some of these speakers have been licensed amateurs, members of government departments, and representatives of rescue groups. From these speakers we learn a lot about our hobby and how we can help other organisations who use the 11 metre band for the benefit of the community.

CB clubs all over Australia have their own policing system for keeping nuisances off the air. No club member will converse with a known station who abuses the air waves and these nuisances soon become despondent when nobody will QSO with them. Of course in the eventuality that a club member abuses the air waves he will in most cases be chastised by his club and in cases that warrant it he will be expelled from the club.

With legislation and the policing of the air waves by clubs we can look forward to members using the air waves responsibly. With the large acceptance of the community towards CB more people are buying CB gear without giving thought to what to do with it. It is the aim of most clubs to give these people the benefit of experience gained by the older club members. It is much better for a person without CB experience to join one of the larger clubs and so gain information, than to try and learn by himself. At clubs he has a pool of information to draw from.

As well as the technical knowledge available to members, some clubs have a social committee whereby various outings are planned. The FX club encourages its members to mix with each other and we have organised many activities to achieve this. Over the last year our activities have included BBQs, picnics, boat rides, bowling nights, film nights and observation car rallies. All the people who attended these outings have had a good time and they have proven very popular with the members.

Some ot the clubs are only QSL clubs (such as the KT club) where there are no social outings or meetings. However these clubs offer the benefit of using a PO Box number whereby people contacted by club members can write in while their identities are preserved.

Some of the social CB clubs also

CB CLUBS

have their own PO Box number for QSL and for contacting the club members. The FXCBRC has as its QSL Box, PO 509 Bankstown. The FX club also has an added advantage for its members: printed club QSL cards available at a small cost (5c). This enables the members to use a club card to send interstate or overseas and so save themselves the hassle and expense of having their own cards printed.

The FXCBRC also has a multi-coloured t-shirt with the club emblem printed on it with the club member's call sign and handle (if requested). The t-shirts give the members their identities and are very popular with both the male and the female members of the club.

There are many female members of the FXCBRC and they take an active part in the committee and the ladies auxiliary. We have many young ladies and married women and mothers who participate both in CB and organising club activities. Also set aside is a special FX number for the children of members. We promote the involvement of the family in CB activities.

People from all walks of life are members of our club; we have teachers, public servants, business men, shopkeepers, clerks, policemen, truck drivers, factory workers, etc. The response by truck drivers to our club has resulted in us giving them a special suffix after their call sign so they can recognise each other on the long haul from Sydney around the "Circle".

The FXCBRC has a special service to SWR a CBer's antenna for him, free of charge, to enable him to obtain the optimum from his or her CB rig.

If after reading this article you decide to join a club bear in mind that there are many clubs in different areas. Contact a CBer in your area and he will discuss with you the advantages of joining the local club.

The address of the Foxtrot Xray Citizens' Band Radio Club is Box 509 PO Bankstown 2200 or you can ring 70-5515 and speak to the club president (Stephen Wagstaff). The FXCBRC has members in country areas as well as interstate and anyone is welcome to join.

Other clubs can be contacted by writing to the NCRA, PO Box M101 Sydney Mail Exchange 2012.

ADVERTISERS INDEX

CB SUPPLIERS

Below are the names and addresses of suppliers of CB equipment. If you know of any suppliers that are omitted please send us details.

ACE RADIO	136 Victoria Rd, MARRICKVILLE 2004	NSW
AERO ELECTRONICS	Shop 13, 191 Ramsgate Road, RAMSGATE	NSW
AURIEMA	PO Box 604, BROOKVALE, 2100	NSW
BAIL ELECTRONIC SERVICES	60 Shannon St., BOX HILL NORTH 3129	VIC
BRIGHT STAR CRYSTALS	35 Eileen Rd., CLAYTON	VIC
CITIZENS BAND ELECTRONICS	32 Bilaar St. KIRRAWEE	NSW
COMMAND AUTO ACCESSORIES	11 Salisbury St., BOTANY 2019	NSW
DEITCH BROS.	70 Oxford St., SYDNEY 2010	NSW
DICK SMITH ELECTRONICS	162 Pacific Highway, GORE HILL	NSW
	125 York Street, SYDNEY 2000	NSW
	361 Hume Highway, BANKSTOWN	NSW
	166 Logan Road, Buranda, BRISBANE	QLD
	656 Bridge Road, RICHMOND	VIC
	and many distributors throughout Australia	
DICK WOODS ELECTRONIC	77 Edgeworth David Ave., HORNSBY.	NSW
EDGE ELECTRIX	31 Burwood Road, BURWOOD 2134	NSW
ELECTRONIC AGENCIES	117-115 Parramatta Rd, Concord.	NSW
FOUR WHEEL DRIVES	304 Middlebrough Rd., BLACKBURN SOUTH	VIC
HACO	PO Box 49, KENSINGTON, 2033	NSW
HAM RADIO SUPPLIERS	323 Elizabeth Street, MELBOURNE 3000.	VIC
HOSE & EQUIPMENT	11 Salisbury St, BOTANY 2019	NSW
INTAG MARKETING	42 Grantham St., WEST BRUNSWICK	VIC
	34 Sydenham Rd., MARRICKVILLE	NSW
LAFAYETTE ELECTRONICS	94 St Kilda Rd., ST. KILDA 3182	VIC
M&K COMMUNICATIONS	561 Pittwater Rd., BROOKVALE 2100	NSW
MS COMPONENTS	164-166 Redfern Street, REDFERN	NSW
MOBILE ONE	227 Victoria Rd., MARRICKVILLE	NSW
NEW ELECTRONIC	57A The Centre, SEVEN HILLS 2147	NSW
PETER SHALLEY	554 Pacific Highway, KILLARA 2071	NSW
RADIO DESPATCH SERVICE	869 George Street, SYDNEY 2000	NSW
RADIO HOUSE PTY. LTD.	306-308 Pitt Street, SYDNEY 2000	NSW
	760 George Street, SYDNEY 2000	NSW
RADIO PARTS	562 Spencer St., WEST MELBOURNE 3003	VIC
SIDEBAND ELECTRONICS SALES	23 Kurri St., LOFTUS 2232	NSW
STRATO COMMUNICATIONS	25 Wentworth St., PARRAMATTA 2150	NSW
TANDY	throughout Australia (almost)	
CHS TAYLOR WAREHOUSES	169 Johnson St., COLLINGWOOD 3066	VIC
TELEVIEW	218 Chapel Street, PRAHAN 3181	VIC
UNITREX	414 Collins St., MELBOURNE 3000	VIC
VICOM	139 Auburn Rd., AUBURN 3123	VIC
	23 Whiting St., ARTARMON 2064	NSW
WILLIS TRADING	429 Murray St., PERTH 6000	WA
XENON WORLD IMPORTS	P.O. Box 33, WARRADALE 5046	SA

Project 631–2

KEYBOARD ENCODER

Last December we published details of an ASCII encoder, Project 631, which used an HD0165 encoder IC. For a few months this device has been difficult to obtain, but that didn't deter one of our readers, David Kinny, who redesigned the project to overcome this problem. Here David describes his project, ETI 631-2.

COMPUTER TERMINAL PROJECTS

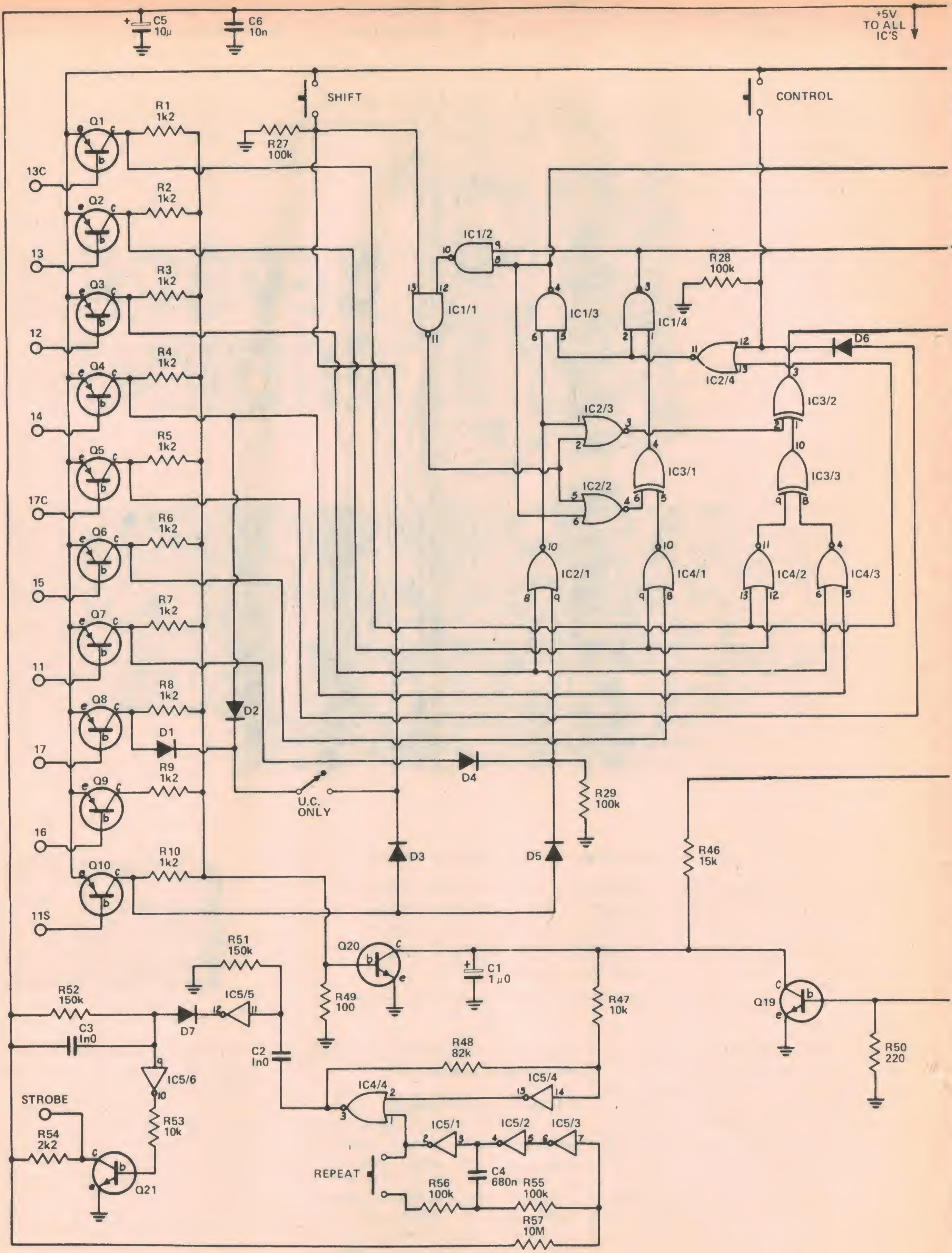
ONE OF THE most frustrating problems that can confront designers of electronic equipment is that of component availability. Often the problem only occurs after a magazine design has been finalised and published, despite the fact that component suppliers may have given assurances of availability.

This project was designed as an alternative to the ETI 631 Keyboard Encoder, which has had its share of these problems. I soon realised that it would in fact be somewhat cheaper to build than the previous design. The prototype was built for about $10 plus the cost of the printed circuited board.

DESIGN FEATURES

The design has the same input and output specifications as the ETI 631 encoder, and can be used directly with ETI 632 Video Display Unit. All the components used in this project are readily available. A single sided pc board is used; this results in a cost saving since these are cheaper to manufacture than double sided boards. The board is almost the same size as that used in the ETI 631, so no problems should arise if you have already designed a chassis to take that board.

How this design differs from the previous design is that Small Scale Intergrated CMOS or LOCMOS ICs are used for all logic functions. Whereas the 631 used the HD0165 IC to encode the 16 keyboard lines O to F, we now use four 4078 8-input NOR gates to generate output bits 1 to 4. A fifth 4078 is used along with a spare EXCLUSIVE-OR gate to generate the "key pressed" signal.



C5
10μ
C6
10n
+5V
TO ALL
IC'S
SHIFT
CONTROL
R1
1k2
R27
100k
Q1
13C
Q2
R2
1k2
13
Q3
R3
1k2
12
Q4
R4
1k2
14
Q5
R5
1k2
17C
Q6
R6
1k2
15
Q7
R7
1k2
11
Q8
R8
1k2
D1
17
Q9
R9
1k2
16
Q10
R10
1k2
11S
D2
U.C.
ONLY
D3
D4
D5
R29
100k
IC1/2
IC1/1
IC1/3
IC1/4
R28
100k
IC2/4
D6
IC3/2
IC2/3
IC3/1
IC3/3
IC2/2
IC2/1
IC4/1
IC4/2
IC4/3
R46
15k
Q20
C1
1μ0
R47
10k
Q19
R50
220
R51
150k
R52
150k
IC5/5
D7
C3
1n0
R49
100
C2
1n0
R48
82k
IC4/4
IC5/4
IC5/6
STROBE
R53
10k
R54
2k2
Q21
IC5/1
IC5/2
IC5/3
REPEAT
C4
680n
R56
100k
R55
100k
R57
10M

Another difference is the repeat oscillator, which uses 3 INVERT gates rather than a 555 timer IC. INVERT gates are also used for the Schmitt trigger and monostable.

CONSTRUCTION

Construction should present no problem to the experienced constructor, however take care, as some of the printed circuit tracks are very fine and could be damaged by heavy-handed soldering. Use a miniature type iron and fine gauge solder. Normal precautions against static damage should be taken when soldering the ICs. Note that resistors, if ½W types, should be the new miniature ones, not the older larger ones, which could cause problems in areas of high component density.

Begin by soldering in the wire links, only two of which needed to be insulated. Then solder in the resistors and capacitors making sure the two tantalums, C1 and C5, are correctly oriented. Take similar precautions with the diodes. Beware, there are two types of BC548/558 transistors, the Philips type and the other. They have different lead connections. This board was designed for the Philips type (with offset base lead), so if you use the other type make sure you orient them correctly.

When all other components are installed, solder in the ICs. Do not use IC

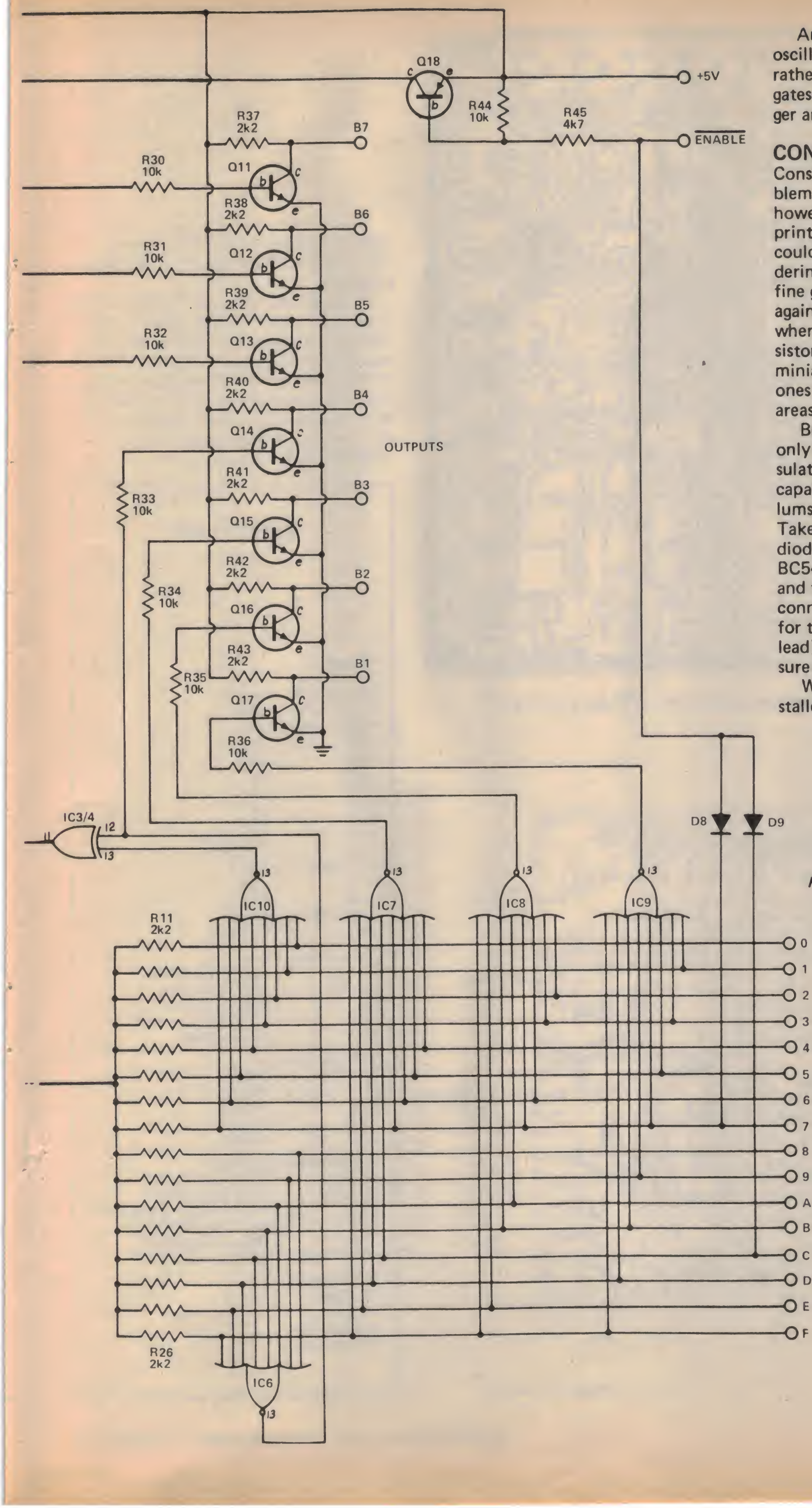


Fig. 1. Circuit diagram of the encoder.

KEYBOARD ENCODER

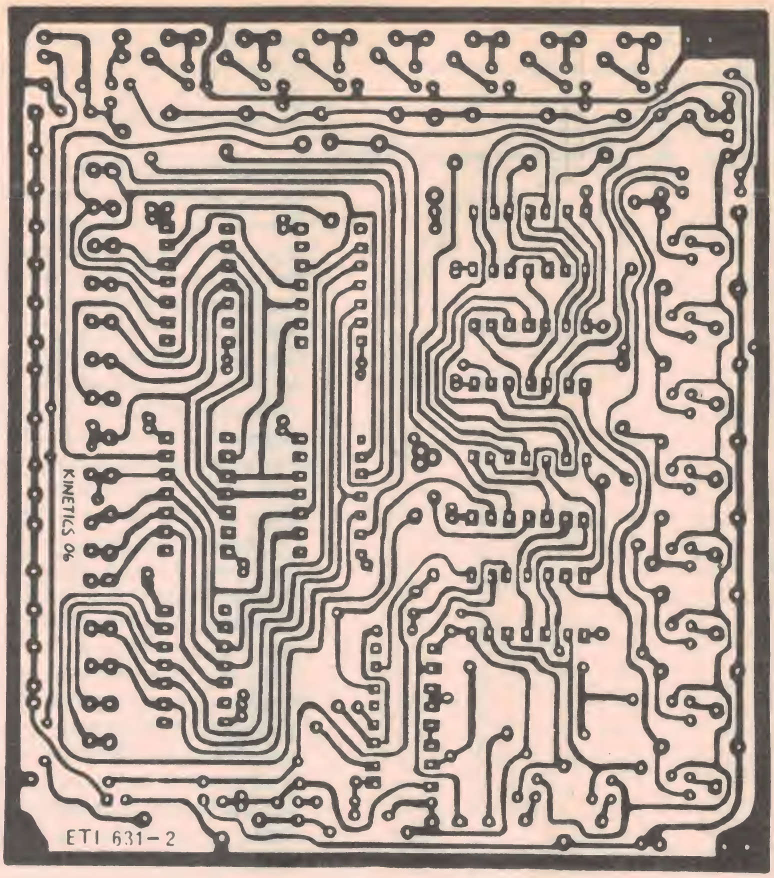


Fig. 2. Artwork for the printed circuit board (note: ETI 631-2 is a single-sided board).

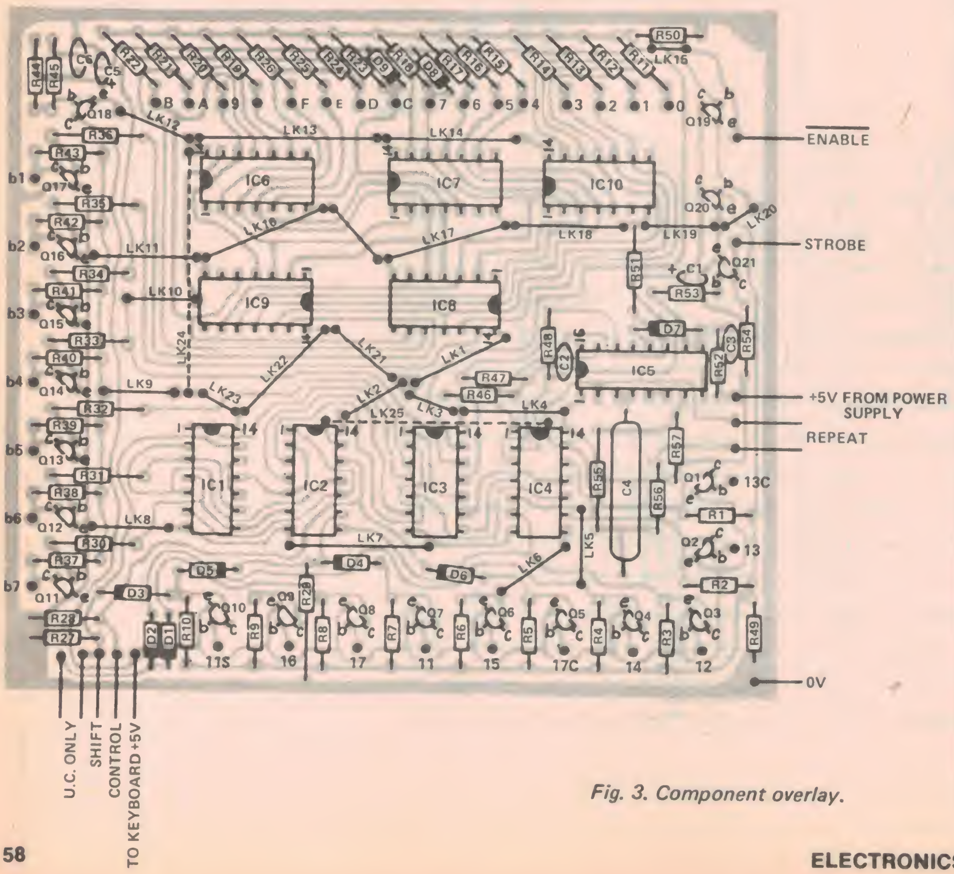


Fig. 3. Component overlay.

sockets, as they tend to take up more room than the ICs and can create space problems.

Ribbon cable was used to wire up the keyboard — being colour coded it helps prevent wiring errors. The keyboard connections are identical to those of the ETI 631, except that both sides of the repeat key must be wired to the board. Note that lines O to F do not run in that order on the pc board; they run 01234567CDEF89AB.

PARTS LIST

Resistors:	
R1 — R10	1k2
R11 — R26	2k2
R27 — R29	100k
R30 — R36	10k
R37 — R43	2k2
R44 —	10 k
R45	4k7
R46	15 k
R47	10 k
R48	82 k
R49	100 ohms
R50	220 ohms
R51, R52	150 k
R53	10 k
R54	2k2
R55, R56	100 k
R57	10 M
Capacitors:	
C1	1 µ0 10 V tantalum
C2, C3	1 n0 polyester
C4	680 n polyester
C5	10 µ tantalum 10 V
C6	10n ceramic
Semiconductors:	
D1 — D9	1N914
Q1 — Q10	BC558
Q11 — Q17	BC548
Q18	BC558
Q19 — Q21	BC548
ICs, CMOS or LOCMOS	
IC1	4011 Quad NAND
IC2, IC4	4001 Quad NOR
IC3	4030 or 4070 Quad X-OR
IC5	4049 Hex INVERT (Do not use 4009)
IC6 — IC10	4078 8 - input NOR
Miscellaneous	
PC board	
PC pins	
Hookup wire	
Ribbon cable	

TESTING

To test the unit, seven LEDS can be connected from the output pins to earth, to provide a visual output check. Ground the ENABLE input, and power up. A 1110000 code should be present on the output, this is inherent in the design and no cause for worry. If a keyboard has been wired, check to see the correct outputs are generated for all keys, including two-key (Control and Shift) functions. If a mistake is noted it is almost certainly a keyboard wiring fault. Connect the ENABLE input to +50V, this should give output 1111111, which should be unaffected by all keys.

If a keyboard has not yet been wired up, a jumper lead can be used to connect one of lines O to F to one of the other ten lines to check outputs. The Strobe output cannot easily be checked except with an oscilloscope, this should not however be necessary.

How It Works

This encoder is a 16-line by 10-line matrix encoder. When a character key is pressed one of the 16 lines 0 to F is connected to the base of one of the 10 transistors Q1 to Q10. This biases the transistor on, giving a high logic level on that line and on the collector of the transistor. ICs 6 to 9 encode lines 0 to F, generating the lower 4 output bits. ICs 1 to 4, connected to the collectors of Q1 to Q10, generate the upper 3 output bits, as well as providing control and shift functions. The outputs of all these ICs are negative logic levels, since transistors Q11 to Q17 are used to buffer the IC outputs.

Q18 switches the +5 V rail supplying Q1 to Q10 and the control and shift keys. When the enable input is high, Q18 will be turned off and the emitters of Q1 to Q10 will be floating, disabling the upper 3 output bits. The enable input is also connected via diodes D8 and D9 to lines 7 and C, which disables output bits 1 to 4.

Shift functions are created by inverting bit 5 if bit 7 is low, and inverting bit 6 if bit 7 is high. This occurs whenever the shift key is pressed, or if the 'upper case only' switch is closed, whenever an alphabetical key is pressed. Line 11s is used for the space key, and gives an automatic shift. Control functions are created by setting bits 6 and 7 low, this occurs either when the control key is pressed, or when a key on line 13c or 17c is pressed. Control functions always override shift functions: if the shift key has been locked and a control key is pressed the correct control output code will be generated.

To create a 'key pressed' signal, the output of IC 6 is EXCLUSIVE-ORed with the output of IC10. The output of the EXCLUSIVE-OR gate charges C1 via R46. C1 connects via R47 to a schmitt trigger formed by IC4/4 and IC5/4. The output of the schmitt trigger goes high about 15 ms after a key is pressed, causing the monostable, formed by IC5/5 and IC5/6, to generate a 200 microsecond pulse, which is buffered by Q21, providing the strobe (Data Available) output.

Keyboard entering errors are detected by Q20 and Q19. When one key is pressed voltages are developed across R49 and R50, both of these voltages are about 400 mV, insufficient to bias Q19 or Q20 on. If two keys are pressed simultaneously the voltage across either R49 or R50 is sufficient to turn the respective transistor on, preventing C1 from charging and disabling the strobe output.

The three spare gates of IC5 are connected as a ring oscillator with a frequency of about 10 Hz. When the repeat key is pressed the oscillator runs, clocking the schmitt trigger. If no key has been pressed, however, this has no effect upon the strobe output. R57 prevents gates IC5/1,2 & 3 from operating in the linear mode when the repeat key is not pressed.

HOW TO ORDER

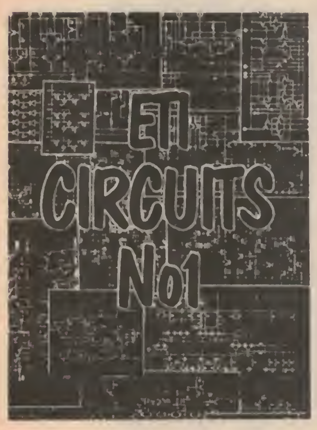
ETI Circuits No 1, the Electronics It's Easy series, and Top Projects Vol 3 are available now from most newsagents or directly from ETI. Project Electronics will be available from newsagents and ourselves from May 9th onwards (approximately).
The Transducer and the Synthesizer books are available only from us and a number of kitset suppliers, they are not sold via newsagents.

Send orders to Electronics Today International
15 Boundary St,
Rushcutters Bay
NSW 2011

ELECTRONICS IT'S EASY Vol 1/2/3.

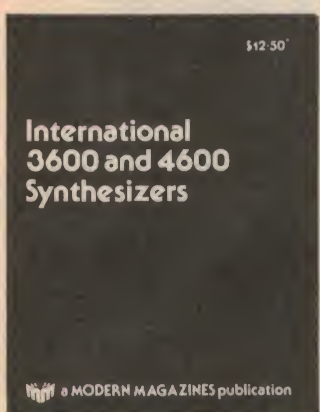
Volumes 1 & 2 now reprinted as a second edition!

Vol 1. The first 12 parts of this very successful series produced as a 100 page book. This volume takes the reader from an introduction to electronics through to operational amplifiers.
Vol 2. The 'middle-third' of the series introduces the reader to more sophisticated techniques, and includes power supplies, waveforms, filters and logic systems.
Vol 3. The final volume covers digital displays and systems, computers, transmission systems, instrumentation and the control of power.
$3.00 per volume plus 40 cents per volume post and packing (60 cents post and packing total if two or three volumes ordered at the same time.)



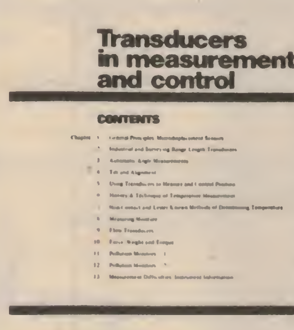
ETI CIRCUITS NO 1

Just published! Available from your newsagent or directly from us. This is a new concept in specials. ETI Circuits No 1 contains over 200 circuits largely based on the Tech Tips and data sheet sections of ETI. Great care has been taken to index each circuit carefully to enable the reader rapidly to locate the item sought. This publication is likely to be regarded as a 'bible' by the experimenter for not only does it contain complete circuits but also ideas and circuit sub-assemblies.
$2.50 plus 40 cents postage and packing.



INTERNATIONAL 3600 AND 4600 SYNTHESIZERS

A totally revised and updated reprint of ETI's phenomenally successful music synthesizer book.
This book has been beautifully printed on heavy art paper and has a sturdy cover varnished for protection.
Available only from ETI and some kit set suppliers $12.50 including postage and packing.



TRANSDUCERS IN MEASUREMENT AND CONTROL

This book is an unusual reprint from the pages of ETI. It is a compilation of a series of articles completed about two years ago — which was so highly thought of by the University of New England that they republished the series splendidly for use as a standard textbook.
Written by Peter Sydenham M.E., Ph.D., F. Inst. M.C., F.I.I.C.A., this publication covers practically every type of transducer and measuring technique and deals with equipment and methods not covered in any other book.
Enquiries from educational authorities, universities and colleges for bulk ordering are welcomed.
$4.50 plus 50 cents postage and packing. Available only from Electronics Today International directly.

TOP PROJECTS Vol 3

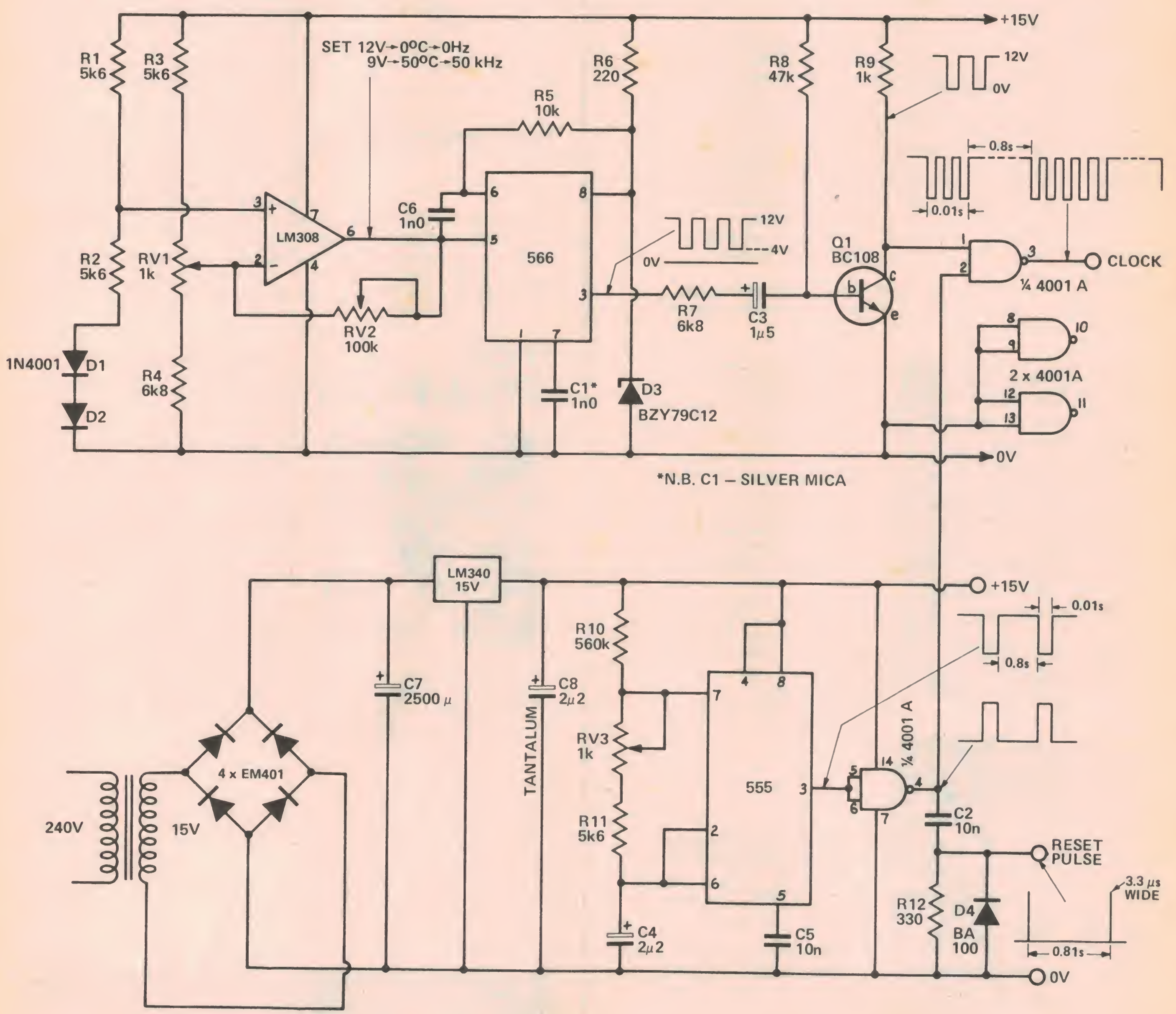
Available from newsagents or directly from Electronics Today International.
Published in October 1976.
Contains FM Tuner, 25 Watt Amplifier, Active Crossover, Crossover Amplifier, Booster Amplifier, 50 Watt Power Module, 400 Speaker System, Audio Noise Generator, Cross-hatch/Dot Generator, ETI Utiliboard, Linear IC Tester, Dual Beam Adaptor, Impedance Meter, Tone Burst Generator, Digital Display, Digital Voltmeter, Frequency Counter, Logic Probe, Logic Pulser, Switching Regulator Supply, Nickel Cadmium Battery Charger, Radar Intruder Alarm, Intruder Alarm, Colour Organ, Car Alarm, Transistor Connections.
$2.50 plus 40 cents postage and packing.

We regret that due to heavy demand, Top Projects Vols 1 and 2 are no longer available.

Simple analogue to digital conversion:

A DIGITAL THERMOMETER

Stephen Collocott, of the University of New South Wales, has constructed this digital thermometer as an exercise in analogue-to-digital conversion; it was designed for use with the ETI533 counter display module. Here he describes how it works . . .



Circuit of Mr Collocott's digital thermometer.

THE AVERAGE HOBBYIST IS often daunted at going "digital" due to the cost and complexity of the conversion of the analogue signal to a digital signal. However, the A-D conversion can be performed in cases where great accuracy is not required by the use of a voltage controlled oscillator whose output is gated, for a known time interval, into a counter. It is on this principle that a simple digital thermometer was constructed, utilizing the ETI533 counter display module.

The thermometer is designed to operate over the range from 0°C to 50°C with an accuracy of ±0.2°C. The ultimate accuracy and sensitivty of the instrument is primarily a function of the sensor used, the input amplifier and the linearity and frequency stability of the VCO. The measurement of the temperature is based on the fact that the forward voltage-temperature coefficient of a silicon diode is linear with temperature (in the temperature range of interest). This voltage (approximately) -2mV/°C is amplified by a dc amplifier whose output controls the VCO. The VCO's output is then fed to a gate which is controlled by a second oscillator which determines the sampling time of the instrument. The output from the gate is finally fed to the counter display unit.

The circuit is relatively simple, consisting of four integrated circuits. A bridge consisting of resistors R_1, R_2, R_3, R_4, RV_1 and the temperature sensing diodes (two used, to improve the sensitivity) is used in conjunction with a DC amplifier, IC1, to detect the temperature variations. As the input voltage to the op amp is only -4mV/°C it is necessary to select an amplifier with a low temperature drift characteristics, such as the LM308. The output of the DC amplifier feeds directly into the VCO which is a single-chip VCO (LM566) which has both square and triangle wave outputs. The VCO has a frequency stability of approximately 200 ppm/°C when used with a silver mica timing capacitor. The frequency of the VCO is given by

$$f_o = \frac{2(V_s - V_c)}{R_5 C_1 V_s}$$

$$\text{where } \tfrac{3}{4} V_s < V_c < V_s$$

thus the maximum frequency for a V_s of 12 V occurs at a V_c of 9 V (being dependent on R_5C_1). For the circuit values given, f_o = 50 kHz at 9 V. Note that, as it is necessary to swing the control voltage between 9 V and 12 V to obtain a 0 kHz to 50 kHz frequency variation, the VCO's supply is adjusted to 12 V by the zener diode whilst the rest of the circuit uses a 15 V supply. The output of the VCO is fed via a buffer amplifier, T_1, to one input of a CMOS NAND gate. The sampling times are controlled by an astable multivibrator formed by IC3, a 555 timer. The multivibrator enables the NAND gate for 0.01 then disenables the gate for 0.8s. The resultant pulse train is fed to the clock input of the counter. A reset pulse to reset the counter is derived from the differentiator $R_{12}C_2$. Thus if we have a 20 kHz signal on a gate held open for 0.01s, we get 200 pulses which correspond to a temperature of 20°C. The count time is then 0.01s and the sample update time 0.81s.

The setting-up procedure is as follows; initially the sensors are placed at 0°C in an ice bath and RV1 adjusted to give 12 V at the output of the op-amp with RV2 set at midrange. It is necessary to then place the sensors in a warm water bath at 50°C and adjust RV2 for 9 V at the output of the op-amp. This procedure may need to be repated several times to ensure accurate calibration. Finally the gate-open time is adjusted by varying RV3 so the display indicates the correct temperature.

The power supply requirements are satisfied by the use of 15 V three-terminal regulators.

Clearance Sale ~ up to 80% off

MANUFACTURER'S SURPLUS STOCK

Prior to stocktaking we must clear our shelves of discontinued lines and surplus stock. All are new unused components, reduced to a fraction of normal cost to clear. Only available while stocks last. Please indicate several alternatives in order of preference.

PLASTIC POINTER KNOBS

Length x height mm. Colours available

32 x 16 ....Red with white line
32 x 16 Black
42 x 15 Black, cream, white

ROUND PLASTIC KNOBS

Diam. x height mm.	Colours available
19 x 16	Cream, red
19 x 11	Brown, red
41 x 19	Black
32 x 13	Cream, brown, black, grey
25 x 11	Black, cream, brown
25 x 11 (3/16" bore)	Red, cream
32 x 13	Cream with gold insert
21 x 16	Cream, black
17 x 16	Cream, black
17 x 16 (3/16" bore)	Cream, black
ALL ABOVE	**5c ea.**

VALVE COILS

B/C Oscillator — standard type
B/C Oscillator — hartley type
455 KHz IF transformers
455 KHz BFO coils
1600 KHz IF transformers
1600 KHz BFO coils
S.W. RF coils 2 — 6 MHz
S.W. Aerial coils 2 — 6 MHz
S.W. Osc. coils 2 — 6 MHz
S.W. RF coils 6 — 18 MHz
S.W. Aerial coils 6 — 18 MHz
S.W. Osc. coils 6 — 18 MHz

TRANSISTOR COILS

8" B/C Aerial loopsticks
Min. ferrite slab Aer. coils
455 KHz IF transformers (not Aegis brand)
455 KHz BFO coils

RF CHOKES

2.5 mH 50 mA
4.5 mH 250 mA

ALL ABOVE . . . 50c ea.

CAPACITORS — Axial Leads

330pF 125V Styro	11c
47uF 35V Electro	15c
50uF 100V Electro	23c
470uF 25V Electro	41c
2500uF 35V Electro	$1.10

2 Henry 26 mm. potcore	$1
Min PVC tuning capacitors	$1
Rocker switches DPDT	75c

RESISTORS 1/8, 1/4, 1/2 & w WATT

All common values as used in production.
Assorted pack of 100 ....$1.00

SEMICONDUCTORS

True to type — no substitutes

TRANSISTORS

AD161	$1.67
AD162	$1.64
BC107	27c
BC108	27c
BC109	29c
BC177	26c
BC178	26c
BC179	27c
BC139	52c
BD140	68c
BF115	65c
BF336	92c
BF337	$1.16
BFY50	77c
BFY51	71c
BU108	$5.03
BU126	$4.43
BU208	$5.87
2N102	54c
2N2646	$1.33
2N3053	48c
2N3055	$1.11

Minimum order $2.00. P&P 40c

SIGNAL DIODES	
OA90	14c
1N914	14c
RECTIFIER DIODES	
1N4004 400V 1A	15c
RECTIFIER BRIDGES	
MB05 50V 1.5A	44c
LEDS	
LD55A 5mm AMBER	44c
SCR'S	
2N4443 400V 8A	$2.12
TIMERS	
NE555	77c
INTEGRATED CIRCUITS	
LM7400	43c
LM7404	43c
LM380	$1.61
LM3900	$1.16
LM741N	51c
TBA460	44c

AEGIS PTY. LTD.

Registered office and factory:
347 Darebin Rd., Thornbury, Vic. 3071,
Phone 49 1017, 49 6792
Postal address: P.O. Box 49, Thornbury, Vic. 3071,
Cables & telegrams: "Maegis" Melbourne.

BIP BEACON

A. J. Lowe designed this project to help a friend from his local Blind Association. All the device does is emit a continuous series of 'bips' to enable a blind person get his bearings. So if you know anyone who might like one, have a go at making this simple project.

WHEN BLIND PEOPLE put something down, working around the house or garden, they sometimes have difficulty in locating it again. The Bip Beacon provides a sound signal on to which they can 'home'.

When two blind people arrange to meet at a certain place, each has difficulty in knowing when the other has arrived. The Bip Beacon provides an innocuous signal that says 'I'm here'.

You can build a beacon for about \$3. If you don't know any blind people contact your local Blind Association, they'll be glad to hear from you. Many of these beacons have been built and eagerly accepted by blind folk.

What It Does

The beacon simply emits a series of 'bips' (a 'bip' is a short 'beep') at four second intervals. That's all, but it's enough.

How It Works

The circuit, shown in Fig. 1, is based on one IC, a quad two-input NOR gate. Two of the gates form a slow.running multivibrator the output of which enables the other two gates to form an oscillator whose output is amplified by transistor Q1. Component values are chosen so that a short duration audio note is produced every four seconds or so.

These beacons are most conveniently built in transistor radio cases. Most readers will be able to find one or two of them in which the radio is dead and not worth fixing. As long as the case and speaker are intact that's all that matters.

A suitable printed circuit board design is shown in Fig. 3. The actual circuit is in the middle of a board measuring 65 x 50 mm. This size is large enough to reach the support posts in the typical pocket radio.

The board should be cut and shaped to suit the exact shape of the case. A good way of doing this is first to make a cardboard template and get that right, and then use it to mark the pc board for cutting.

Care must be taken in locating the holes in the board for the mounting screws. Holes are not shown in Fig. 3 as they must be drilled to suit each individual case. A good way of finding hole positions is to make a transparent template from stiff plastic film, using the card template as a guide. The support posts can be seen through this clear template and it is easy to mark the hole positions and transfer them to the pc board.

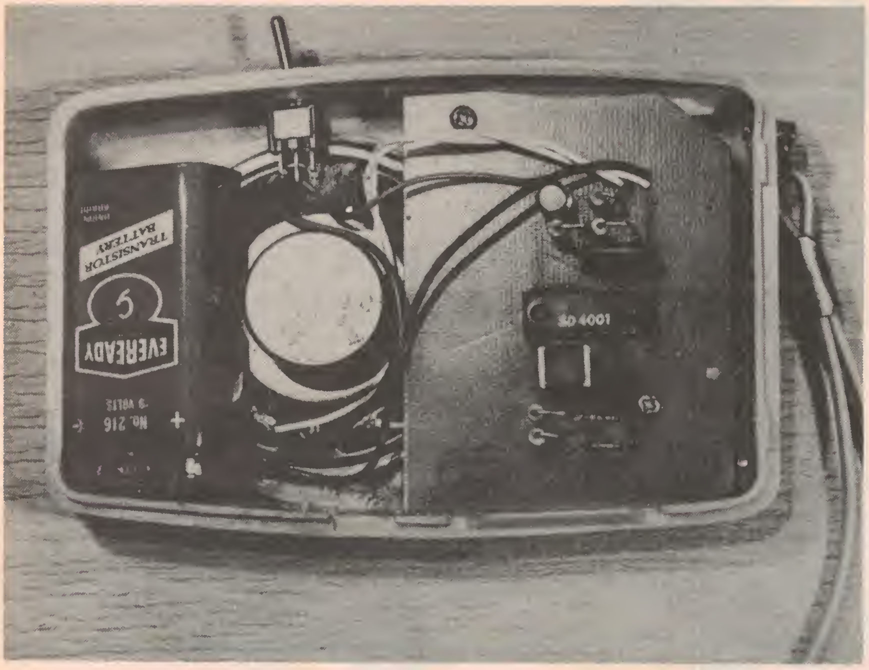
All this cutting, shaping and drilling should be done before mounting any components.

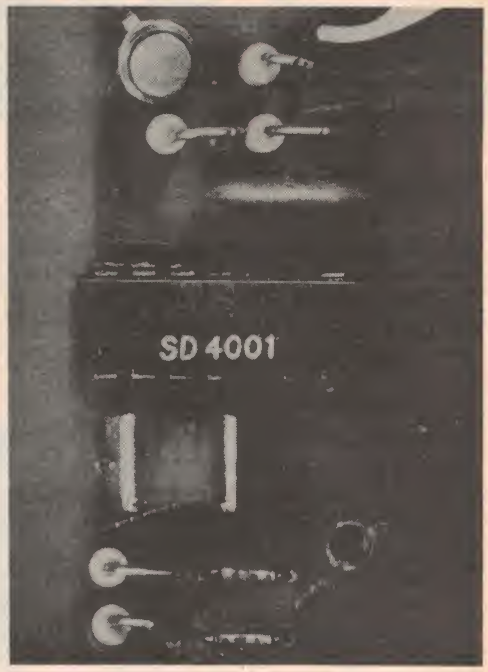
Next mount all the components except R2, whose value must be determined on test to allow for variations in the value of C1. Take care with the correct orientation and handling of IC1 which is a CMOS IC.

The board, with all components except R2 mounted, is then hooked up to the battery and speaker and a value of R2 selected so that the bips occur every four seconds. As R2 is a high value resistor 5.6 megohms or more, it must not be held between hands during this test or spurious results will be obtained. Use test leads with clips.

Finally insert R2 and assemble the board, switch and battery in the case. See the photos.

As these beacons are needed by people who can't repair them themselves, they should be made very





The photographs above show the construction of the Bip Beacon on a pcb which fits inside a cheap transistor radio case.

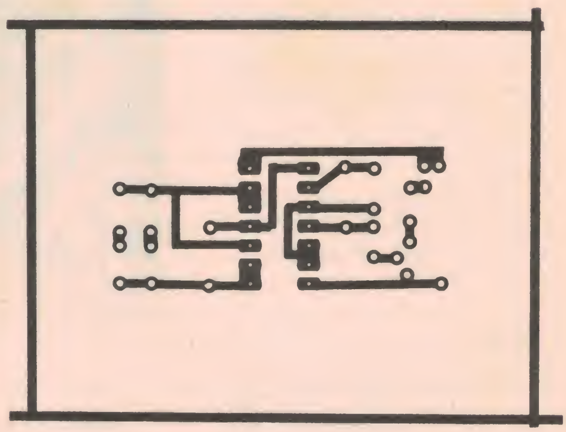
thoroughly — with first class soldered joints.

The photo of the prototype shows one of the Siemens type capacitors in the C1 position. If these are difficult to obtain then a 0.47 μF ceramic capacitor can be used instead. The diodes D1 and D2 can be any small signal diodes.

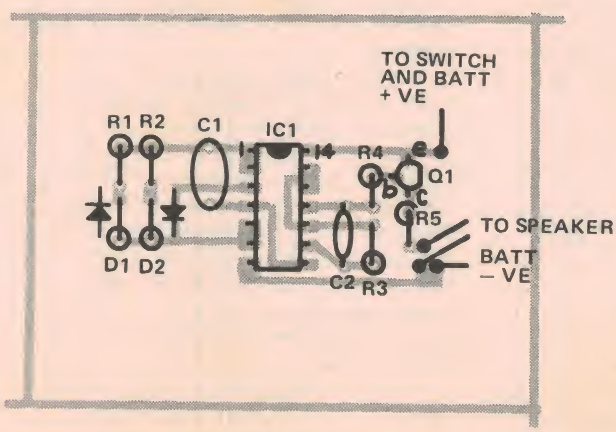
Clubs

Electronic clubs who undertake production of beacons for local blind associations might approach local chain stores to see whether they can provide any new but 'dud' radios which they might otherwise throw away.

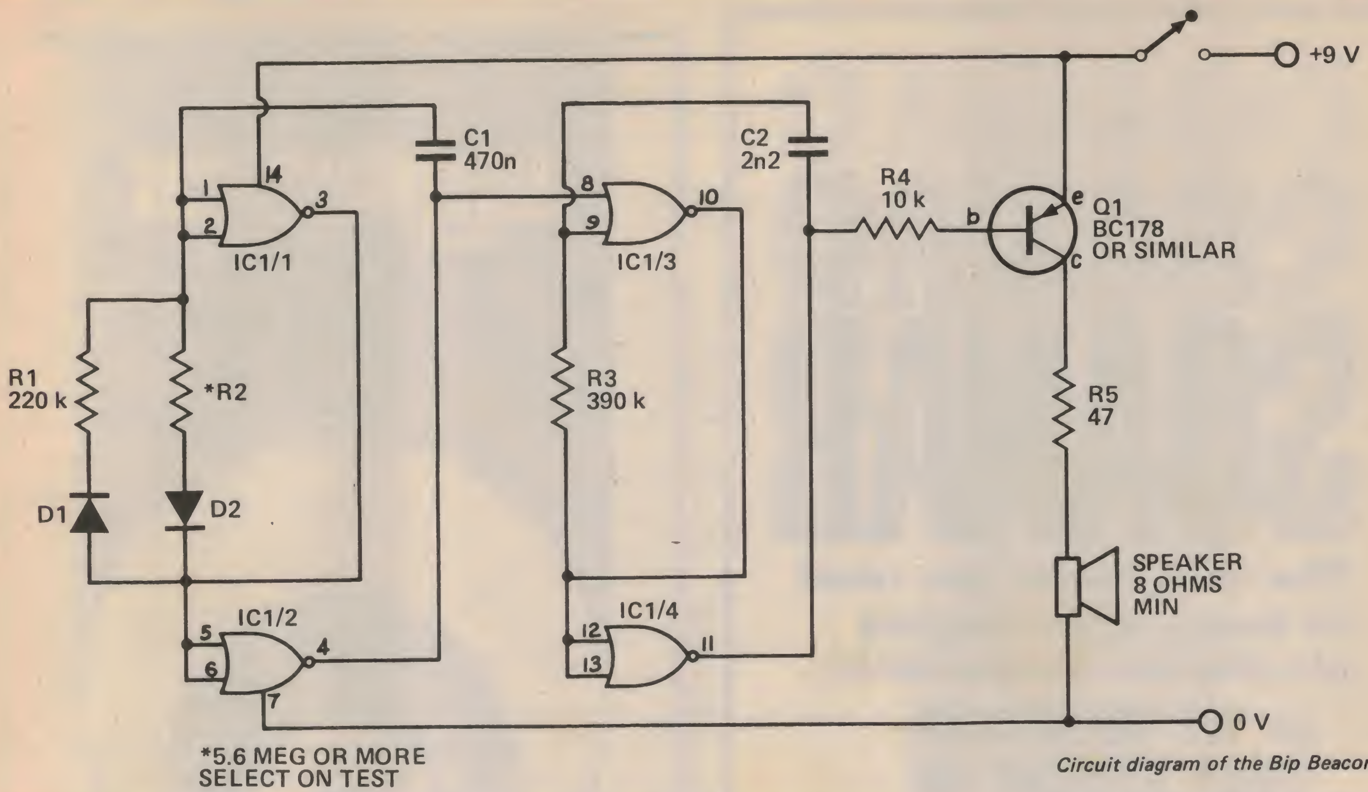
Well there it is — a not very difficult project, but a worthwhile one to help the sightless to 'see'.



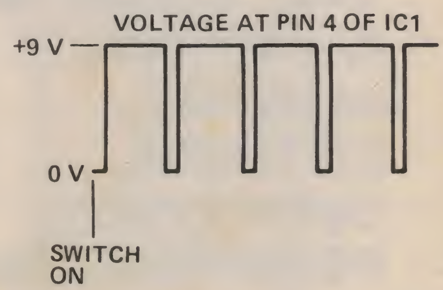
The pcb artwork.



The component overlay.



Circuit diagram of the Bip Beacon



PARTS LIST — ETI 243

Resistors all ¼ watt

R1 220 k
R2 5M6 or more — select on test
R3 390 k
R4 10 k
R5 47 ohms

Capacitors

C1 470 n non polarised — Siemens type or ceramic
C2 2n2 ceramic

Semiconductors

D1 and D2 diodes 1N914 or similar
Q1 transistor PNP type BC 178 or similar
IC1 4001 CMOS

Transistor radio case with speaker and 9 volt battery.
Miniature toggle switch.

How It Works

The IC contains four (hence its name QUAD) NOR gates which are separate from one another except for the power supply connections. Consider any of the NOR gates, such as gate 1, which has its input terminals connected to pins 1 and 2 of the IC and its output terminal connected to pin 3. The NOR description is a short way of saying NOT OR, and it means that – only when the input voltage on pin 1 or pin 2 or both pin 1 and pin 2 is high, (i.e. above about 3½ volts) then the output voltage at pin 3 is low (i.e., at the level of the negative rail). If neither pin 1 nor pin 2 is high i.e. both are low, then the output voltage on pin 3 is high.

That's all there is to a NOR gate. Now, applying this knowledge to the interconnection of the four gates, the description goes as follows:

Consider gates 1 and 2. Immediately after 'switch on' there is no reason why there should be any voltage at pins 1 2 5 and 6. So if 1 and 2 are low, then pin 3 must go high. As this pin 3 is connected to pins 5 and 6 they must go high, and so pin 4 goes low. Now capacitor C1 charges fairly rapidly from pins 3, 5 and 6 through diode D1 and resistor R1. As C1 charges, the voltage at its top end, and hence on pins 1 and 2, increases. When that voltage is high enough gate 1 inverts (because with pins 1 and 2 connected it is an inverter) and its output pin 3 goes low. This makes pins 5 and 6 go low, and hence pin 4 goes high.

Next, C1 discharges through diode D2 and resistor R2 – slowly, as R2 is a very high value resistor. Ultimately the voltage of the top of C1 has fallen to a low value and so it takes pins 1 and 2 down low. So pin 3 goes high, 5 and 6 go high, and 4 goes low, and the process repeats over and over.

From this description it can be seen that the voltage at pin 4 would follow the graph shown in Fig. 2.

Now consider gates 3 and 4. A moment after 'switch on' pin 8 is low because it is connected to pin 4 which is low. Also pin 9 is low because there is no reason why it should be high. So pin 10 goes high, and, following the earlier description, pins 12 and 13 go high and 11 goes low, C2 charges through R3 and when it is charged, which doesn't take long as it is a very small capacitor, then its top end is high. So pin 9 is high. This then sends pin 10 low (that's the NOR gate action), pins 12 and 13 low, and 11 high. The capacitor discharges rapidly through R3 and the cycle repeats at an audio frequency. Its output, pin 11, turns on and off transistor Q1 and so a note is produced by the speaker.

However, at any time when pin 8 is high gate 3 ensures that pin 10 is held low. Hence 12 and 13 go low and pin 11 goes high and transistor Q1 is turned off.

Now pin 8 is connected to pin 4, which, as already seen is high for most of the time and low for only a small fraction of the time – while C1 is charging. Thus the audio output occurs for only short intervals when pin 4 is low.

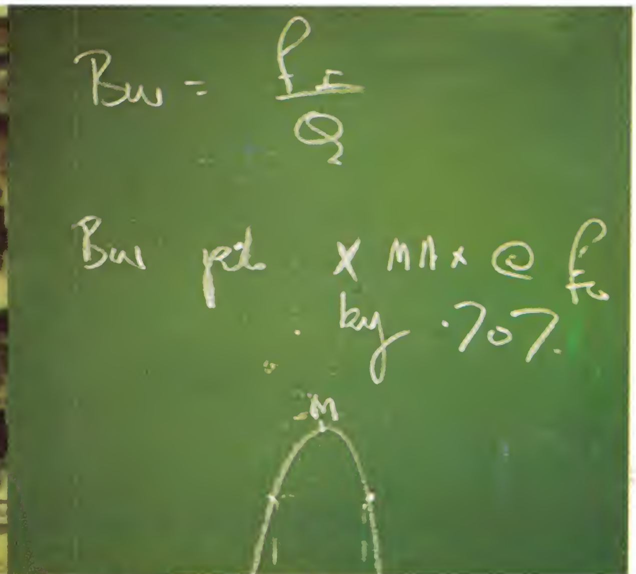
By suitable choice of R1 and R2 the device has been made to give a short bip every four seconds or so.

The pitch of the audio note can be adjusted by selection of R3 and C2.

As the IC used is of the CMOS type its current drain is very low and a long battery life can be expected.

ONE OF THE WORLD'S BEST COURSES IN ELECTRONICS

YOU CAN'T BUY IT-BUT WE'LL PAY YOU TO TAKE IT.



You could call it a super-apprenticeship. You'll live in with a group of blokes your own age. You'll get good pay from day one (practically all of it's yours to spend), and good food.
The technical training we give you has been described as the finest anywhere. You'll learn everything from electrical power generation and distribution right through to the end use, like electric motors, lighting, ventilation and airconditioning systems, and power control electronics. With skills like that, you're a pretty valuable guy.

That's why we guarantee you a key job after training, the chance to travel overseas, more time off than you'd expect, sport of all kinds, and a lot more. In today's Navy. Now, who else but the Navy could offer you all that?

MOVE INTO A BIGGER WORLD

Now you've learnt a little of what a Navy apprenticeship can offer, why not find out more about it. Call at your nearest Navy Recruiting Centre or mail this coupon to: NAVY CAREERS OFFICER, P.O. Box XYZ (in your capital city). Applications close 4th April, 1977, so if you're between 15 and 17½, do it now.

NAME...

ADDRESS...

STATE..............................P'CODE...................AGE...........

Authorised by Director-General of Recruiting, Dept. of Defence. NAP89/FP.27

ETI data sheet

LM 3909, LED flasher/oscillator

The LM3909 is a monolithic oscillator specifically designed to flash Light Emitting Diodes. By using the timing capacitor for voltage boost, it delivers pulses of 2 or more volts to the LED while operating on a supply of 1.5 V or less. The circuit is inherently self-starting, and requires addition of only a battery and capacitor to function as a LED flasher.

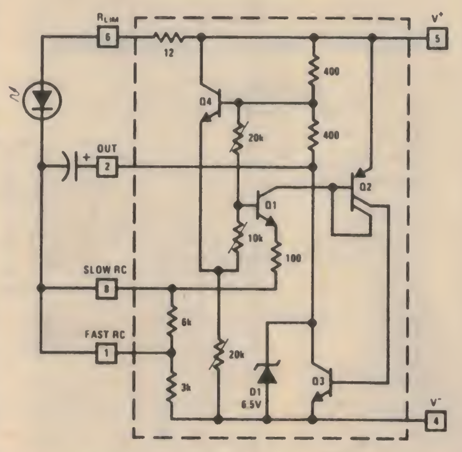
Packaged in an 8-lead plastic mini-DIP, the LM3909 has been optimized for low power drain and operation from weak batteries.

Application is made simple by inclusion of internal timing resistors and an internal LED current limit resistor. As shown in the first two application circuits the timing resistors supplied are optimized for nominal flashing rates and minimum power drain at 1.5 V and 3 V.

Timing capacitors will generally be of the electrolytic type, and a small 3 V rated part will be suitable for any LED flasher using a supply up to 6 V. However, when picking flash rates, it should be remembered that some electrolytics have very broad capacitance tolerances, for example –20% to +100%.

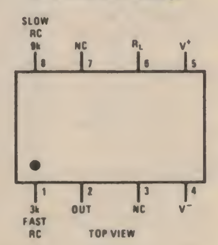
schematic diagram

Typical 1.5V Flasher



connection diagram

Dual-In-Line Package



ABSOLUTE MAXIMUM RATINGS

Power Dissipation	500 mW
V^+ Voltage	6.4 V
Operating Temperature Range	-25^o to $+70^oC$

ELECTRICAL CHARACTERISTICS

Parameter	Conditions	Min	Typ	Max	Units
Supply Voltage	(In Oscillation)	1.15		6.0	V
Operating Current			0.55	0.75	mA
Flash Frequency	300μF, 5% Capacitor	0.65	1.0	1.3	Hz
High Flash Frequency	0.30μF, 5% Capacitor		1.1		kHz
Compatible LED Forward Drop	1 mA Forward Current	1.35		2.1	V
Peak LED Current	350μF Capacitor		45		mA
Pulse Width	350μF Capacitor at 1/2 Amplitude		6.0		ms

ETI data sheet

Features:

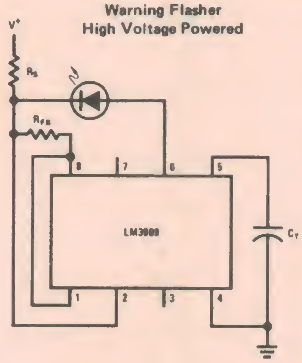
- Operation over one year from one C size flashlight cell.
- Bright, high current LED pulse.
- Minimum external parts.
- Low voltage operation, from just over 1 V to 5 V.
- Low current drain, averages under 0.5 mA during battery life.
- As an oscillator directly drives an 8Ω speaker.

Applications:

- Finding flashlights in the dark, or locating boat mooring floats.
- Sales and advertising gimmicks.
- Emergency locators, for instance on fire extinguishers.
- Toys and novelties.
- Electronic application such as trigger and sawtooth generators.
- Siren for toy fire engine, (combined oscillator, speaker driver)
- Warning indicators powered by 1.4 to 200 V.

additional typical applications

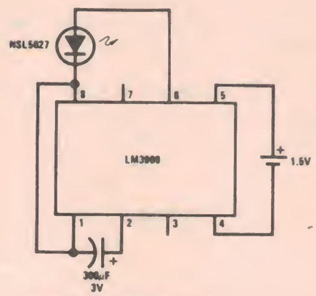
Warning Flasher
High Voltage Powered



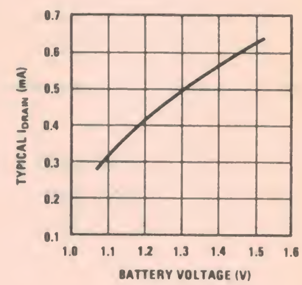
Typical Operating Conditions

V^+	NOMINAL FLASH Hz	C_T	R_S	R_{FB}	V^+_{RANGE}
6V	2	400μF	1k	1.5k	5–25V
15V	2	180μF	3.9k	1k	13–50V
100V	1.7	180μF	43k 1W	1k	85–200V

1.5V Flasher



Note: Nominal flash rate: 1 Hz.



Estimated Battery Life
(Continuous 1.5V Flasher Operation)

SIZE CELL	TYPE	
	STANDARD	ALKALINE
AA	3 months	6 months
C	7 months	15 months
D	1.3 years	2.6 years

Note: Estimates are made from our tests and manufacturers data. Conditions are fresh batteries and room temperature. Clad or "leak-proof" batteries are recommended for any application of five months or more. Nickel Cadmium cells are not recommended.

APPLICATIONS NOTES

Note 1: All capacitors shown are electrolytic unless marked otherwise.

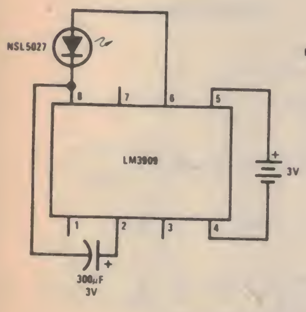
Note 2: Flash rates and frequencies assume a ±5% capacitor tolerance. Electrolytics may vary −20% to +100% of their stated value.

Note 3: Unless noted, measurements above are made with a 1.4 V supply, a 25°C ambient temperature, and a LED with a forward drop of 1.5 V to 1.7 V at 1 mA forward current.

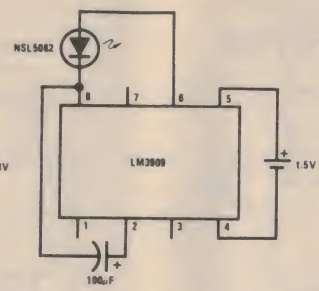
Note 4: Occasionally a flasher circuit will fail to oscillate due to a LED defect that may be missed because it only reduces light output 10% or so. Such LEDs can be identified by a large increase in conduction between 9.9 V and 1.2 V.

typical applications

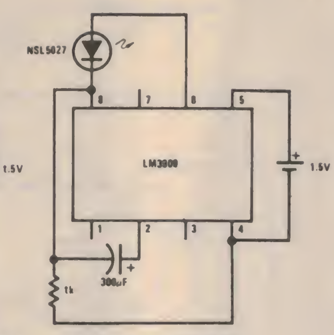
3V Flasher



Minimum Power at 1.5V



Fast Blinker

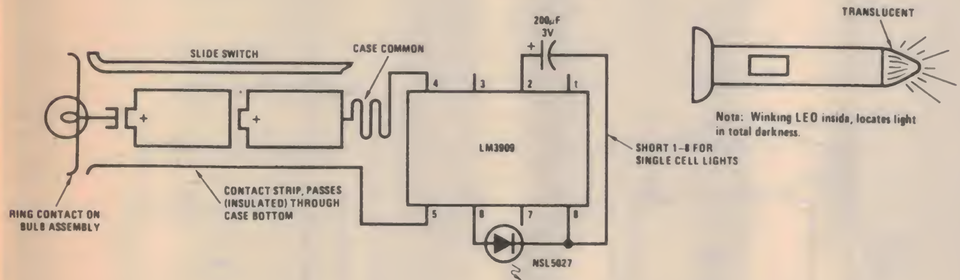


Note: Nominal flash rate: 1 Hz. Average I_{DRAIN} = 0.77 mA.

Note: Nominal flash rate: 1.1 Hz. Average I_{DRAIN} = 0.32 mA.

Note: Nominal flash rate: 2.6 Hz. Average I_{DRAIN} = 1.2 mA.

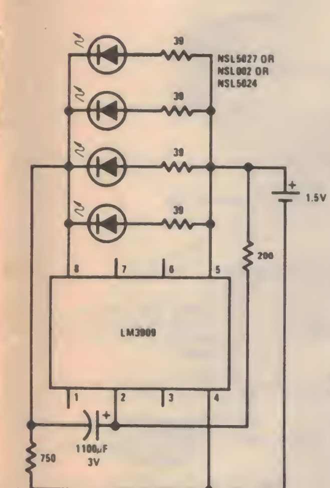
Flashlight Finder



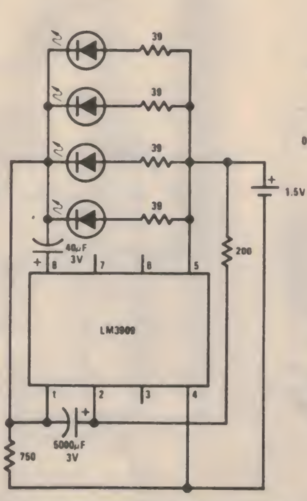
Note: Winking LED inside, locates light in total darkness.

Note: LM3009, capacitor, and LED are installed in a white translucent cap on the flashlight's back end. Only one contact strip (in addition to the case connection) is needed for flasher power. Drawing current through the bulb simplifies wiring and causes negligible loss since bulb resistance cold is typically less than 2 Ω.

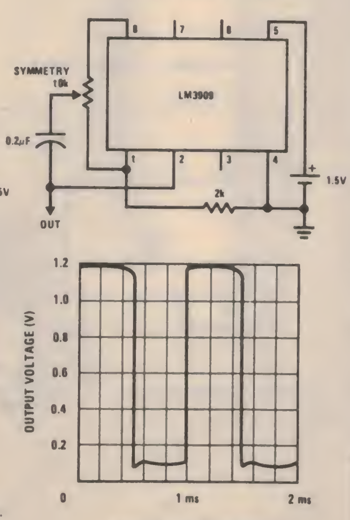
4 Parallel LEDs



High Efficiency Parallel Circuit



1 kHz Square Wave Oscillator



Note: Nominal flash rate: 1.3 Hz. Average I_{DRAIN} = 2 mA.

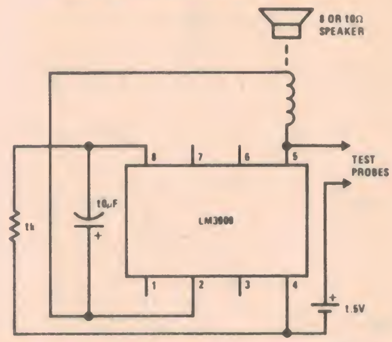
Note: Nominal flash rate: 1.5 Hz. Average I_{DRAIN} = 1.5 mA.

Note: Output voltage through a 10k load to ground.

ETI data sheet

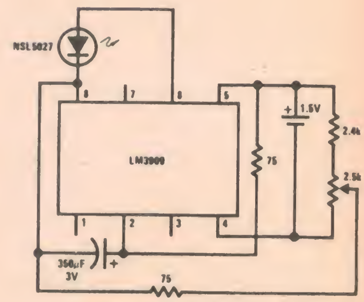
typical applications (con't)

"Buzz Box" Continuity and Coil Checker



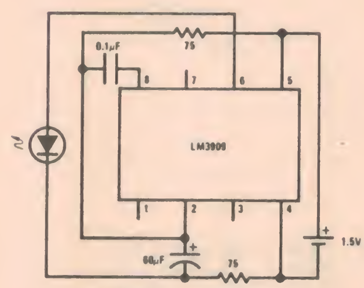
Note: Differences between shorts, coils, and a few ohms of resistance can be heard.

Variable Flasher



Note: Flash rate: 0–20 Hz.

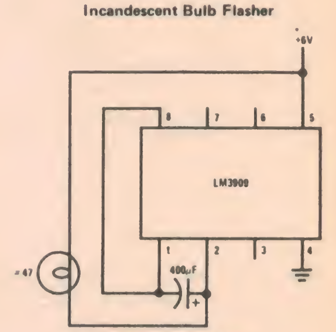
LED Booster



Note: High efficiency, 4 mA drain.

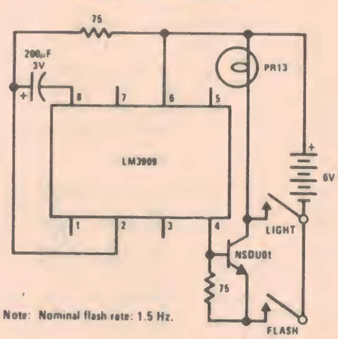
Note: Continuous appearing light obtained by supplying short, high current, pulses (2 kHz) to LEDs with higher than battery voltage available.

Incandescent Bulb Flasher



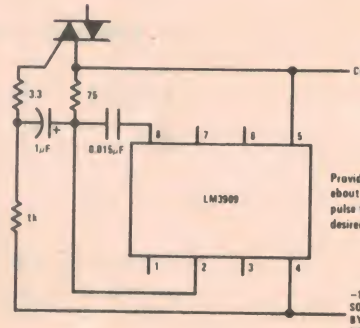
Note: Flash rate: 1.5 Hz.

Emergency Lantern/Flasher



Note: Nominal flash rate: 1.5 Hz.

Triac Trigger



Provides 40 mA, 10μs pulses at about 8 kHz. Triac gate may be pulse transformer isolated if desired.

−1.4V FROM BATTERY OR SOLAR CELL WITH 5μF BYPASS CAPACITOR. DRAIN NOMINALLY 5 mA.

EDUCAL

THE KIT SPECIALISTS
No. 1 IN PRICE WHERE IT REALLY COUNTS

AM-FM STEREO TUNER KIT

$89

FEATURES
- PRE-ALIGNED FM MODULES (3)
- MONO/STEREO
- LOCALLY PRODUCED— NOT IMPORTED
- 4 PRE-SET STATIONS ON FM
- FULL RANGE MANUAL TUNING AM-FM
- 75 or 300Ω INPUT
- A.F.C.
- STEREO BEACON
- PROFESSIONAL FINISH

SPECIFICATIONS
TUNING 88-108MHz
BANDWIDTH 300KHz
I.F. 10.7MHz
I.F. REJECTION 65dB
IMAGE SUPRESSION 40dB
A.M. REJECTION 40dB
CHANNEL SEPARATION 38dB (min.)
DIMENSIONS 13.75" x 10.5" x 4.25"

P.&P. $2.50

XMAS SPECIAL
CDI KIT
(12v Ne. earth)

CAPACITOR DISCHARGE IGNITION

FULL KIT FULL CDI
- Less points wear
- Less plug wear
- Better starting
- More m.p.g.

$22.50

STEREO-AMP KIT

30 WATTS/CHANNEL RMS • FREQUENCY RESPONSE 8Hz-30kHz • (3dB down) 20Hz-20KHz (FLAT) • DISTORTION 0.1% INTO 8Ω • FULL BASS & TREBLE CONTROLS • LOUDNESS CONTROL • DIN SOCKET PHONES SOCKET • TEAK VENEER CASE • MAG. CARTRIDGE INPUT • AUX. INPUT TAPE INPUT •

$79

NOTE ALL KITS EX STOCK SENT RETURN MAIL.
MAIL ORDERS BOX No.182, CARLTON SOUTH, VIC. 3053.
OR EDUCAL, 21 WELLS AVENUE, BORONIA, VIC. 3155 (Tel. 762 5713).

MICROWAVE RADIATION SURVEY METERS

For monitoring microwave radiation levels from domestic, industrial, medical and communication microwave equipment. Ideal for servicing, research, and development work. From **$295.00** complete. Expert advice available. Free booklet on servicing microwave ovens.

MODEL HI 1500
Specifications:
1. Calibrated at 2450 MHz for use in the I.S.M. Band.
2. Three ranges provided: 0-2, 0-10 and 0-100 mw/cm², each calibrated at midpoint.
3. Accuracy ±1 db
4. Time responses (0 to 90% of final value for a step input) Fast — 1 second. Slow — 3 seconds.
5. Temperature compensated.
6. Cardinal point calibration chart provided with each meter.
7. Estimated battery life of 1 year.
8. Instrument package dimensions: 2½" x 3½" x 6".
9. Probe length: 12".

MODEL HI-1500-2
Microwave Interlock System

This system is designed to monitor on a 24 hour basis, equipment or potentially hazardous areas for microwave field intensities from 0.2 to 100mw/cm². The system will latch in a self contained relay having both N.C. and N.O. 2 amp 110VAC contacts which can be used to disable microwave sources, etc. An alarm sound at the same time, alerting personnel of the incident.

MODEL HI-1700
Microwave Survey System
Specifications:
1. Both Analog and Digital displays mw/cm²
2. System accuracy better than ±1 db in 2450 MHz ISM band.
3. Rugged, virtually immune to damage due to high fields.
4. Polarization error less than 5%
5. Audible Alarm, adjustable threshold 0-1- mw/cm².
6. Memory circuit retains max reading up to 5 minutes.
7. BCD logic output — 3½ digits.
8. Recorder output — level adjustable.
9. Fast and slow response time.
10. Easy to set zero adjustment.
11. Replaceable compliance spacer cones (5cm).
12. Precoiled probe lead — extends to 12 feet.

Reg Geary & Associates

4/6 GARDEN AVENUE GLENHUNTLY VIC. Phone (03) 211 8183 All Hours

Agent for Hitachi electric hoists - Electric chain blocks Electric monorail trolleys - Geared disc brake motors · Crane components · Eurobloc wire rope hoists and crane components · P.H.R. hand chain blocks - J.D.N. air operated chain blocks - Endo spring balances - Endo air hoists Renlita remote controlled doors

Potentiometers

Roger Harrison continues his series on components with a look at potentiometers. He looks at the different types and styles and how they are used.

POTENTIOMETERS ARE MADE in such a bewildering array of sizes, shapes, styles, and combinations that it is difficult to sort out what best suits a particular situation and what alternatives there may be. Apart from that, they come in a variety of wattage ratings, voltage ratings, resistance variation 'laws', etc — and how are you going to sort through that lot?

Potentiometers perform some control function by varying a resistance element on by tapping off a voltage from a fixed resistance. The variable resistor may need to be varied continuously so that some control function is performed, or it may be a 'preset' control which is only required for some calibrating or 'trimming' function. Preset potentiometers are generally called 'trimpots'.

So, potentiometers are generally split into two broad categories — **continuously variable** types, which are equipped with a shaft for the attachment of a knob, and **trimpots** which are generally equipped with a screwdriver slot.

TYPES

There are five basic types of potentiometer, classified according to the type of resistance element employed:

(1) Carbon composition
(2) Carbon Film
(3) Hot-Moulded Carbon
(4) Cermet
(5) Wirewound

Carbon composition pots have a composition element moulded to the required size and shape and generally employ a metallic spring-wiper. They are generally quite inexpensive but have the disadvantage that they become noisy after use. Carbon film pots consist of a resistive film that is sprayed or screened onto a phenolic former of the required size and shape. A metallic spring-wiper is also generally used in this type of pot, and the element will withstand many more rotations than a composition type before noise problems. Carbon film pots are also inexpensive and are the commonest types in use, along with Hot Moulded Carbon types. Carbon film pots have a good degree of resolution whereas the composition types are poor in this respect.

Hot Moulded Carbon potentiometers are manufactured by a process wherein the resistive element, insulating base, and terminations are moulded into one integral part. A carbon wiper contact is usually employed. They have a high wattage rating on a size-to-size basis and a high degree of conformity between units. This factor, together with their very high resolution, has led them to be increasingly used as precision controls. They exhibit low noise levels in operation compared with carbon film and wirewound types.

Cermet potentiometers find wide application in precision controls, as trimpots and in many stringent applications (the element is rugged, exhibits low noise levels in use, and has good resolution). Wattage ratings are similar to those for hot moulded carbon pots of a similar size. They are generally somewhat more expensive. A metallic wiper is usually employed.

Wirewound potentiometers consist of a resistance wire would on a former with a metallic wiper, although a graphite wiper contact is sometimes used on low value, high wattage types. They have the disadvantage of being noisy, the resistance changes in small 'steps' as the wiper passes over the turns of wire, and they are usually more bulky than other types of equivalent value. However, they can be made in very low resistance values and they are able to dissipate much more power than other types of equivalent value.

STYLES

The most common, basic style of potentiometer is illustrated in Figure 1. Many variations on this style are possible as is illustrated in the following figures.

A miniature, transistor-radio style pot is illustrated in Figure 3. They are commonly used as volume or tone controls in transistor portables and as 'zeroing' controls for the ohms range on

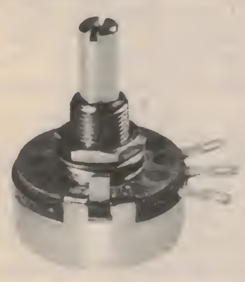


Fig. 1. The common, basic style of potentiometer. It has a threaded bushing and nut for panel mounting through a single hole and standard solder lug terminals.

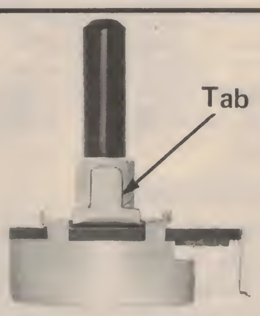


Fig. 2. Another common style is the tab-mounted pot. It has two tabs on opposite sides of the shaft which pass through corresponding panel slots, being secured either by twisting the tabs or laying them flat against the panel.

Fig. 3. A miniature, transistor-radio style pot. It is generally mounted firmly to a printed circuit board or other suitable support with bolts through the large lugs.

Potentiometers

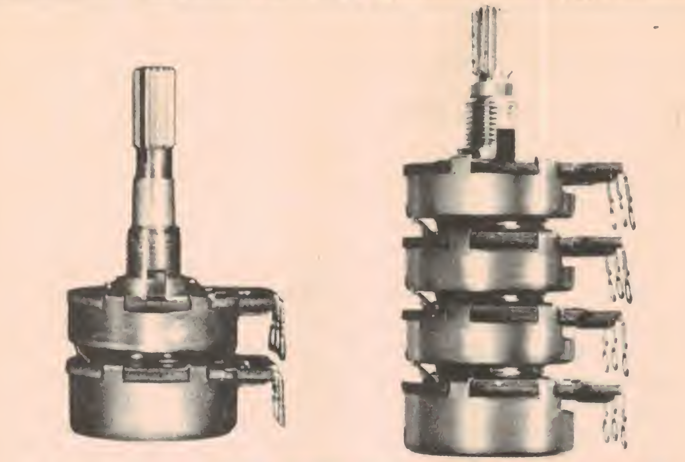


Fig. 4. 'Tandem' or 'ganged' potentiometers consist of several potentiometers controlled by one shaft. 'Dual-concentric' type are similar to the one on the left except that they are separately controlled by concentric shafts, one inside the other — the inner, shaft controlling the 'back' pot and the outer shaft controlling the 'front' pot.

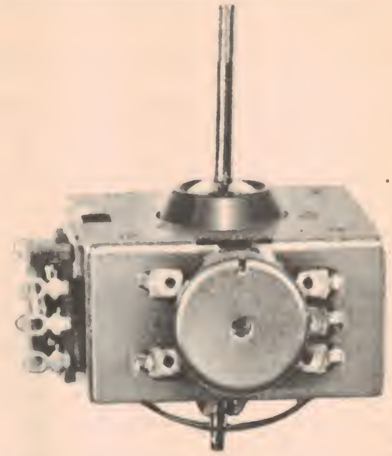


Fig. 5. Lever-controlled 'quad' pot assembly. These assemblies are used for complex control functions such as quadrophonic sound 'balance' and in model control applications etc.

on multimeters, etc. This style of control is generally mounted firmly to a printed circuit board or other support via bolts through the two large lugs. An edge-operated knob is generally fitted to the shaft.

In some applications, 'Tandem' or 'Ganged' potentiometers are required (for example for stereo tone and balance controls). They consist of several potentiometers all connected to the one shaft and stacked one behind the other, as illustrated in Figure 4. 'Dual-Concentric' potentiometers appear similar to the dual-ganged pot on the left in Figure 4. However, in this case, each pot is separately controlled by means of two concentric shafts. Dual-concentric pots are often used where there is limited space (e.g., for the RF and audio gain controls on a communications receiver).

The assembly illustrated in Figure 5 consists of four potentiometers mounted on the four sides of a metal box and connected by means of a special linkage to the lever which may be moved in any direction in a circular pattern. These assemblies are used for complex control functions such as quadrophonic 'balance' controls, radio controlled models etc.

Switches are often mounted on the rear of potentiometer assemblies and connected (mechanically) to the control shaft so that the one control knob may serve several functions. There are three basic types of switches generally used: the rotary type, the push-pull type and push-push type. A standard pot with switch attached is illustrated in Figure 6. The rotary style of switch is often employed as a mains-power switch on a control, such as a volume control. It has the advantage that when the switch is operated to the ON position that the control is at minimum. But, it has the disadvantage that anything up to the first 15% or 20% of the control cannot be used. On many controls this is of little consequence. Push-Push and push-pull (or, more strictly, pull-push) switches have the advantage that the control may be left in a certain position and the switch operation does not disturb it. With a volume control however, this may be disastrous as the equipment may be turned on while the volume control is unwittingly at a high setting, or, worse still, full on!

While solder-lug terminals are commonly found, potentiometers are also manufactured with terminals suitable for printed circuit board mounting, as illustrated in Figures 7 and 8, or with wire-wrap terminals, as illustrated in Figure 9.

POWER RATINGS

With the exception of wirewound types the majority of standard potentiometers are obtainable in ratings of 0.1, 0.2, 0.25, 0.5 and 1 watt. Potentiometers are derated in much the same manner as fixed resistors. If this information is desired it is best to consult the manufacturer's literature.

Wirewound potentiometers are obtainable in ratings up to 100 watts (!!) but more usually they are available in ratings (depending somewhat on their resistance value) of 0.5, 1, 2, 5, 10, 15 and 20 watts. The higher power ones are usually quite bulky. Cermet and hot moulded carbon types are generally the smallest size for a given rating.

RESISTANCE LAW

The resistance 'law' or 'taper', as it is called, of a potentiometer refers to the manner in which the resistance changes (as measured between an end terminal and the wiper terminal) with rotation of the shaft. There are a considerable number of different 'laws' in common use. The main ones however are: linear, logarithmic, reverse logarithmic, and 'S' taper. These are illustrated in Figure 10. Note that various log tapers are used, the 20% log taper is the more common one however. The tapers for both clockwise (CW) and counter-clockwise (CCW) log are illustrated, as the potentiometer may be connected to operate in reverse fashion if desired (often as not though, it's a mistake!). The various common laws are given a letter code which is stamped or marked on the body of the assembly along with the resistance value. The code is quite straightforward, as follows:

A = linear law
B = logarithmic law
C = reverse logarithmic (or anti-log)
S = 'S' law.

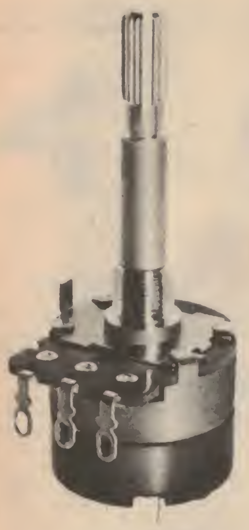


Fig. 6. Standard style pot. With switch attached.

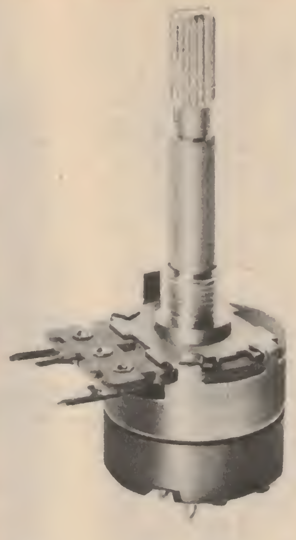


Fig. 7. Switch-pot having printed-circuit terminals perpendicular to the shaft.

Fig. 8. Standard pot having printed-circuit terminals parallel to the shaft. It mounts through the pc board.

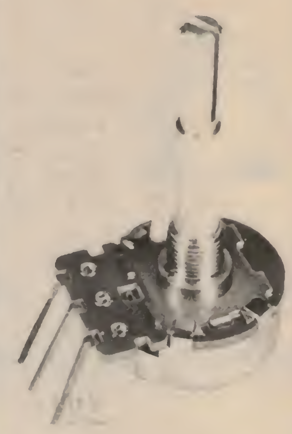


Fig. 9. Standard pot with wire-wrap terminals.

A pot may be marked 25kA, which is a 25k ohm, linear law potentiometer. Another may be marked 1M/C, which is a one megohm, reverse logarithmic pot.

The linear taper control varies resistance in direct proportion to the rotation of the shaft. This type of pot is commonly used in voltage control applications, on tone controls and other applications which require a straightforward voltage division.

With a log law control, the resistance increases very gradually during the initial rotation of the shaft, most of the resistance change occurring in the last 20-30% of the rotation. This type of law approximates the natural sensation of loudness as our ears follow a logarithmic law in their sensitivity to sound amplitude. Consequently, such controls are frequently used as volume controls so that they produce an apparent linear increase in sound output as the shaft is rotated. If a linear control were used, the greatest change in perceived volume would occur within the first 10-20° of shaft rotation.

Anti-log tapers provide the reverse, the greatest change in resistance takes place in the early portion of the shaft rotation, the least change occurs in the last 30-40% of shaft rotation.

The 'S' taper provides only a small change in resistance for the initial and final 20% of shaft rotation and provides a linear variation between these extremes.

Other laws include semi-log and linear-tapered. These have curves that lie between the log and linear curves on the graph in Figure 10. The semi-log law provides a somewhat greater change of resistance-versus rotation over the first 40% of shaft rotation than with the log curve. The linear-tapered provides a nearly logarithmic variation over the first 50% of shaft rotation and a linear variation thereafter.

If the law of a pot is unknown the resistance-versus-rotation may be measured and the result plotted on graph paper.

Resistance Ranges

Most types of carbon element potentiometers are made in values ranging from 50 ohms up to 2 M. Some older types

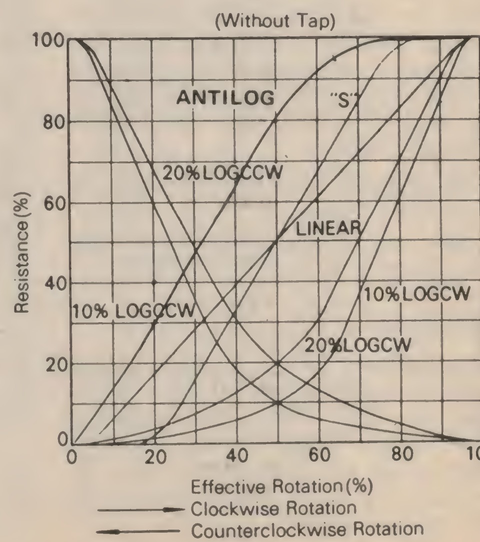


Fig. 10. The common resistance-versus-rotation 'laws' as 'tapers' for potentiometers.

Potentiometers

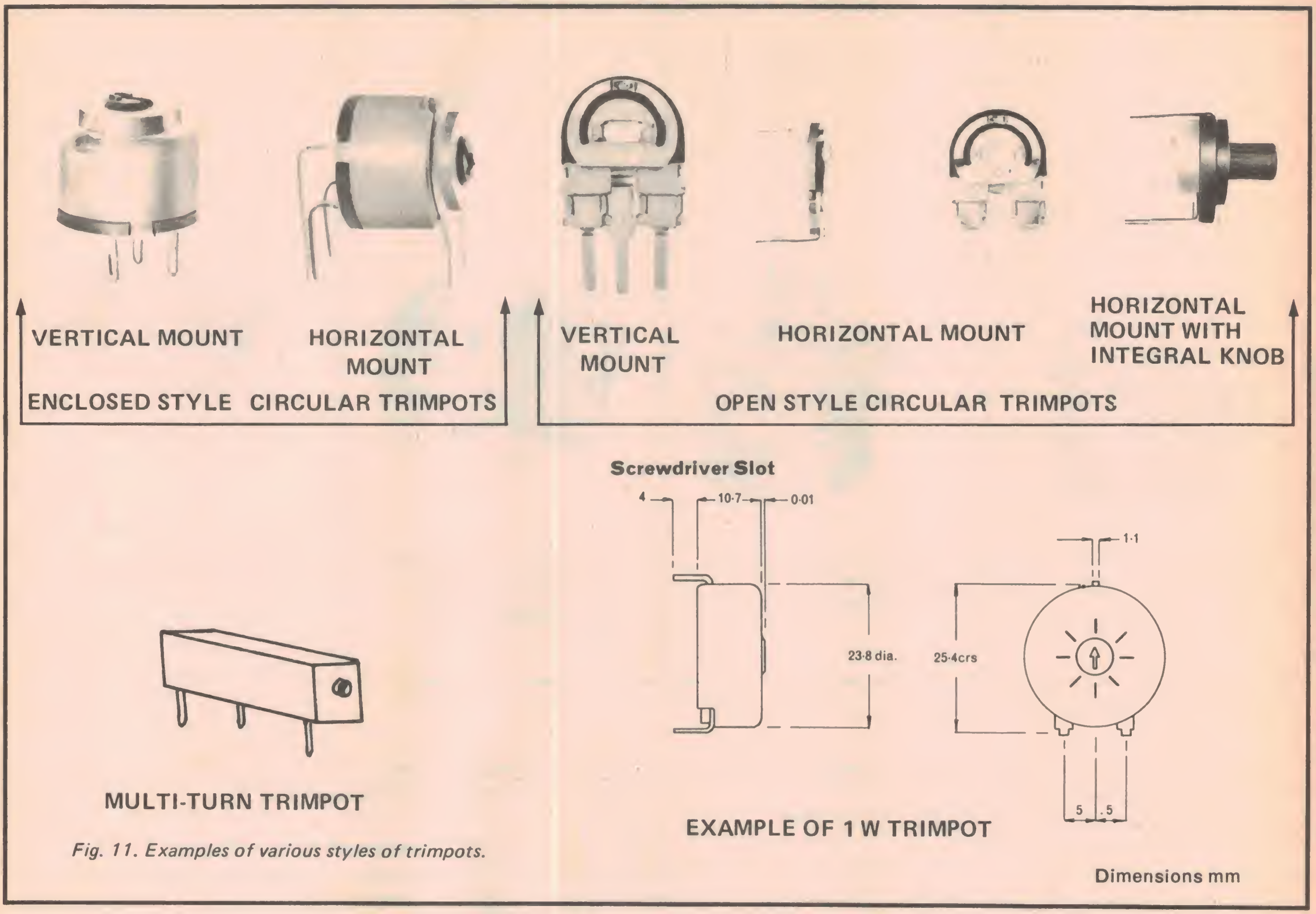


Fig. 11. Examples of various styles of trimpots.

were made in values as high as 500 M. Cermet potentiometers are made in values ranging from 10 ohms to 10 M.

Some manufacturers make their pots to values in the standard E6 (20%) series (i.e: 47 ohms to 2Mz for carbon types). However, many pots are made with values according to the following decade series: 10,15,20,25,50 & 100. i.e: 2 k5, 5 k, 10 k, 15 k, 20 k, 25 k, 50 k, 100 k etc . . .

Some (typically of US make) include 75 in the value range.

Wirewound potentiometers are made in values ranging from 10 Ω to 100 k.

Slide Pots

These are pots having a linear element rather than a circular element as in standard pots. They are available generally with a carbon element having slider ranges of typically 50 mm, 75 mm, and 100 mm in the various laws as previously illustrated.

Slide pots have particular advantages of their own. One being that it is easier to see the proportional position of the control at a glance than with standard potentiometers. In some circumstances the slide pot provides a much more convenient form of control, for example in multi-channel audio mixer applications.

Trimpots

Trimpots are usually 'preset' controls. That is, they are only adjusted occasionally to set certain circuit parameters or conditions, for calibration purposes etc. Consequently they are generally adjustable by means of a screwdriver slot on the control shaft, although some have an integral knob to allow finger adjustment.

Trimpots are made in a wide variety of styles and sizes, as illustrated in Figure 11. Some types are enclosed to prevent the ingress of dust etc which can cause the control to become noisy in operation. Many types are only single-turn controls with the wiper covering only 180° in some cases, while others cover the more conventional 270-280° of rotation. Other trimpots are made for more critical applications and have a multi-turn control which allows a much finer and more accurate adjustments.

Manufacturers make trimpots in values ranging from 50 ohms to 5 M for carbon element types, and typically up to 30 M for Cermet types.

Wirewound types are made in values typically ranging from 100 ohms to 5 k. Wattage ratings for the various types are typically 0.1, 0.2, 0.25, 0.5 up to 1 W. Trimpots are available in the same range of laws as are standard potentiometers, although most common styles have a linear law. Other characteristics are the same as for the type of element employed.

Connecting Potentiometers

One thing that baffles electronics project constructors is the 'correct' way to connect a potentiometer.

The best way to illustrate how to do it is by example. The most common application of a potentiometer is that where it is required to vary a quantity (signal, voltage, etc) so that an increase occurs when the control shaft is rotated *clockwise*. The best example of this is a volume control.

In Figure 12 a pot is illustrated typically as you would see it when you come to make the connections. The arrow indicates the direction in which the control shaft will be turned to increase the output. THE TERMINAL IN THE CENTRE IS ALWAYS THE WIPER CONNECTION. So, terminal 1 (on the left as you view it to wire it up), connects to 'ground' or minimum.

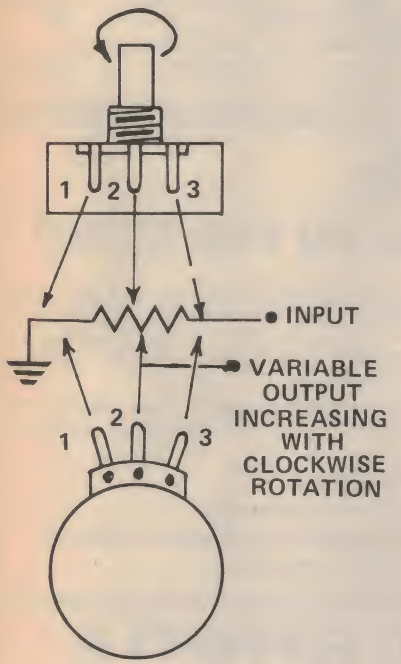


Fig. 12. Connecting a pot as a simple 'increase clockwise' control (e.g. volume).

Terminal 2 (the wiper) connects to the output (in some cases it can also be the input terminal; operation of the pot still remains the same). Terminal 3 (the one on the right) connects to the input (or the output if the input is connected to the wiper).

Try it out for yourself. Get a 1 k (linear is best) pot and a battery (anything from 1.5 V to 9 V will do), hook up the battery with the positive to terminal 3, and the negative, to terminal 1. Connect a voltmeter (multimeter or what-have-you) with the negative to terminal 1 and the positive lead to terminal 2. Commence with the control shaft at the fully anti-clockwise position (hard left!). As you slowly rotate the shaft clockwise, the reading on the multimeter will rise. True! It's easier to do it than it is to read about it. The wiper, in this case, commences at terminal 1 and moves towards terminal 3.

Some applications require the pot to work in the reverse fashion. For example, as a frequency or pulse rate control in an oscillator or multivibrator. In such cases, an increasing effect occurs as the wiper traverses towards the 'minimum resistance' end of the control. The pot is simply connected so that terminal 1 is the 'maximum resistance' end of the control and terminal 3 the minimum.

In some applications the circuit shows that the wiper is shorted to one of the 'end' terminals. But which one? Terminal 1, or 3? In such cases it depends on whether the 'maximum effect' occurs at minimum or maximum resistance. Look at Figure 13. The circuit shows that as the wiper traverses the element it shorts out the section of the track it has just traversed, decreasing the resistance as it moves towards the terminal which is not connected to the wiper. Leaving one 'end' terminal unconnected achieves the same purpose.

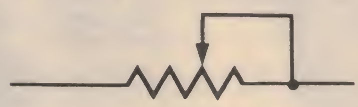


Fig. 13. Pots in some applications require only a variation in resistance. Which terminals are connected together depends on the circuit effect.

If the *maximum* effect (from the circuit in which the pot is to be connected) occurs at *minimum* resistance then terminals 1 and 2 are connected together. Maximum resistance (and thus minimum effect) occur at fully anti-clockwise rotation (hard left!). The effect increases as the control is rotated clockwise.

On the other hand, if the *maximum* effect occurs at *maximum* resistance then terminals 2 and 3 are connected together. Thus, as the control is rotated clockwise from the fully anti-clockwise position the resistance, and thus the effect, increases.

PRINT-OUT

MICROBIOLOGY. The conclusion to the discussion on the 8080 scheduled for this issue has been delayed and will be in next months ETI.

NEXT MONTH we look at a locally available 8080 microcomputer kit and fight a battle in space when we try out a space war program.

THE D2 – YOUR PERSONAL COMPUTER?

Now available in Australia, Motorola's new evaluation kit is causing quite a bit of excitement. It seems that many of the kits are being bought for other than evaluating the 6800. Instead they are finding their ways into their owners homes to be used as personal computers. So we at ETI decided to have a closer look at the kit and here is what we found.

WHEN THE MICROPROCESSOR was developed a few years ago those involved in marketing it realised they faced a more than difficult task in gaining industry acceptance for it.

The instrument chosen to break down the resistance was the 'evaluation module' or 'evaluation kit'. Usually these kits contained just enough hardware to get a microprocessor working and a rather basic monitor program to operate the system through a teletypewriter.

Looking back, it has to be admitted that the evaluation kit is a success. It has helped many people come to grips with the microprocessor. Realising this, at least one company has not left the evaluation module in a static state of development, instead that company, Motorola, has found ways of improving their first evaluation kit the D1, and now have released the Evaluation Kit II (or D2 as it is more commonly known).

The D2 had its Australian debut at the Motorola exhibition held in the US Trade Centre in December last year.

But it was not until February this year that the D2 became generally available and Print-Out was able to put one together to check it out. Having done so we say we are impressed with it, for just about all areas of the D1 have been improved upon and some new features added.

The most striking of these features is the new Keyboard/display module. With this module and a 5 volt power supply the evaluation kit becomes a completely self contained microcomputer with input/output facilities that allow the operator to enter and debug his programs. That's to say no additional terminal is required for the user to operate the D2 microcomputer.

To keep the cost as low as possible

How it comes. Between the covers of this book there's enough 'bits and pieces' to build a working microcomputer. All you have to add is a 5 volt power supply.

the D2 evaluation kit is supplied as a kit of parts — it has to be assembled before it can be used. The method of packaging is interesting as it comes in three sections sandwiched between the covers of a rather large three-ring binder. One 'section' contains the microcomputer printed circuit board and components. another 'section' contains the keyboard/ display printed circuit board and its components, while the remaining 'section' is a set of three manuals.

In the manuals section the System Design Data manual is a collection of data sheets on the 6800 family of chips. The Programming Reference manual is the basic software reference documentation that explains what each instruction in the 6800 repertoire does and provides brief notes on pertinent techniques of programming the 6800.

The remaining manual is called the Evaluation Kit II manual and it contains the information needed to assemble the kit and operate it. This takes the form of circuit diagrams and pc board overlays and for the operator there is detailed explanation of each of the keyboard commands. The Evaluation Kit II manual also has a complete source listing of the D2's monitor program and a set of flow charts for easy understanding of how the monitor functions. With this information it is relatively easy for the programmer to use the monitor routines as subroutines in his own program. This lets him use the keyboard and display to input and output data to this program.

A good monitor program is essential for ease of actually operating a microcomputer (and for the operator's sanity). Motorola have apparently recognized this when they designed the D2 and produced Jbug because it certainly is an improvement over Mikbug. Eight of the 24 keys provided on the keyboard/ display module are command keys used by the operator to control Jbug. A summary of their functions follows.

The M key permits examination and, if necessary, changing of the contents of any memory location. The memory location to be examined is first opened by entering its address (a 4-digit hex number) then pressing the M key. The display will now show the memory address on the four left-hand displays and the contents of the memory on the two right-hand displays. New data may now be entered by pressing the appropriate hex keys. Or the next memory location can be displayed by pressing the G key.

The E Keys forces the microcomputer to stop executing your program and to start executing Jbug instead. In doing this the current contents of the microprocessor's internal registers (accumulators, program counter, etc.) are saved in memory so the operator can examine them to find out what part of his program was being executed when the E key was pressed. The saved values can also be re-entered into the microprocessor to continue the user's program from the exit point.

The R key permits examination of the MPU's registers. Once pressed the display shows the contents of the program counter. Then the Index register, accumulators A and B, Condition code register and Stack Pointer may be displayed sequentially by pressing the G key. If required the contents of any register can be changed by using the M key's memory changing function.

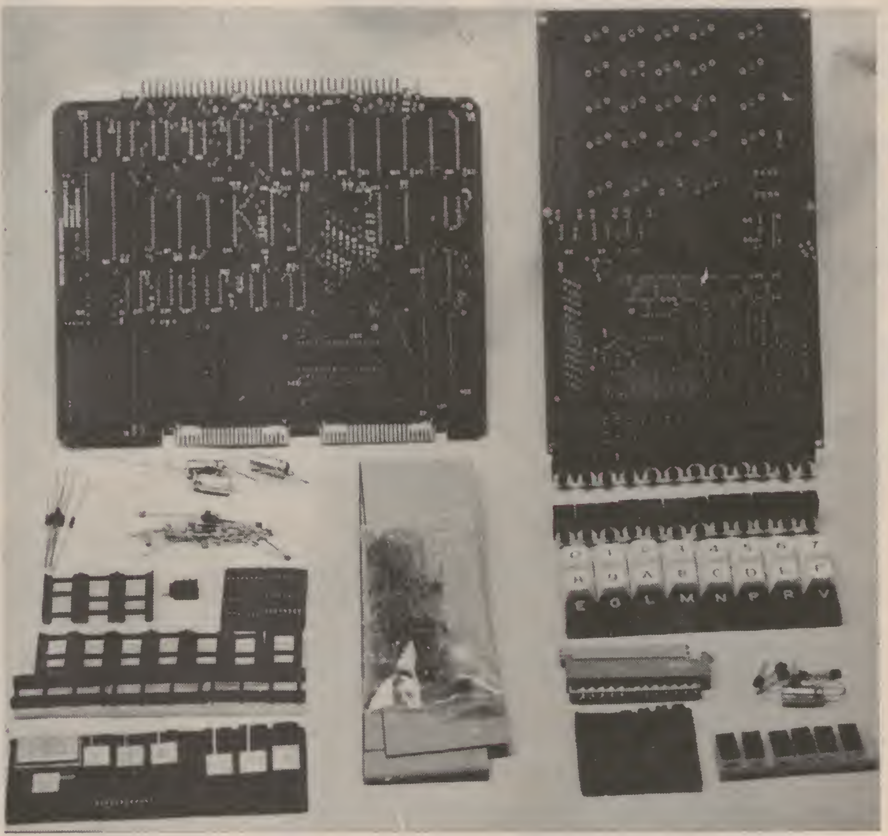
In pressing the G key the operator directs the MPU to go and execute the user's program. This function is evoked by first entering the starting address of the program in memory and then pressing the G key. The user's program now has total control of the microcomputer.

We now look at the key labelled P. The P stands for punch, which is a bit of a misnomer because the D2 doesn't punch the operator (for his heavy hand), the programmer (for his faulty programs) or paper tape. The punch label is a leftover from the D1 where it was used as a command to punch holes in paper tape for a permanent record of memory.

Punchers, unfortunately, are expensive, usually costing more than the D2, so the family audio tape recorder is used instead. To save a block of data currently in memory, the audio recorder's microphone input is connected to the corresponding point on the keyboard/ display module, the stop and start address of the block is entered and the P key pressed.

Making taped copies of memory is of no value unless what is on the tape can be transferred back into memory. This is performed by routines in Jbug evoked by pressing the L or load key. The L key then complements the P key for permanent storage of programs and data.

Interestingly the D2 uses the 'Kansas City Standard' recording formal that is very popular with personal computerists in the US. With this standard, data is recorded at 300 baud (approximately 30 bytes per second) using eight cycles of 2400 Hz to represent a logical 1 and four cycles of 1200 Hz to represent a logical 0. A feature of the Kansas City Standard is its wide tolerance to speed variations in the audio tape recorder.



To keep the cost as low as possible the D2 comes as a kit of parts as shown in this layout. On the top left is the microcomputer pc board and on its right the Keyboard/display pc board. Bottom left shows the MOS LSI chips inserted in conductive plastic foam. In the centre is the cable that connects the two modules and on the botoom right is the keytops and seven segment LED displays.

This allows the use of low cost ($50) cassette recorders. In fact a note in the evaluation kit manual claims the D2 accommodates speed variations of approximately 25%.

The V key is for setting and removing up to 5 break points. These are temporary stops in the program that enable the user to run only part of his program to test whether it is performing correctly. Once encountered you proceed to the next part of the program by first pressing the E key then the G key.

The T key evokes the Trace function which permits stepping through your program one instruction at a time. This gives you adequate time between the execution of each instruction to monitor the result of executing that instruction.

The remaining feature of Jbug is a short routine that calculates the offset to a branch instruction.

What I/O is there on the D2?

Two PIAs and a ACIA come as standard on the microcomputer module. These are two 6800 family chips designed for interfacing to the external world. The PIAs provide 32 single I/O ports each capable of acting as an input or an output and eight other lines that can be programmed to act as interrupt inputs. Four of the eight can also act as outputs that are convenient to use as strobe signals to let the peripheral know that there is data ready to be used.

The ACIA is there to provide data formatting and control to interface serial asynchronous peripherals to the 8 bit data bus of 6800. Software control of the ACIA provides variable word length, transmit and receive control, interrupt control and parity control and checking.

Note, however, one of the PIAs and the ACIA are used for interfacing to the keyboard/display module. This does not mean they cannot be used to interface to other peripherals just that it's difficult to do both at the same time.

How much memory is there?

The kit comes with 384 bytes of RAM of which 128 bytes is allotted for Jbug's use (note you can use some of this, at a pinch). There are holes on the pc board (with tracks to them) for two more memory chips to give a RAM capacity of 512 bytes.

For those who want more the appropriate address, data and control signals are taken via holes that accommodate buffer chips (which you have to add) to a Exorciser-compatible edge-connector where up to 65K bytes can be addressed.

The only ROM supplied with the D2 is a 1K byte mask-programmed device containing Jbug. However holes are provided with strapping option to accommodate more ROM.

For those who would like to extend the memory there is always the vacant wire wrap area (see photo).

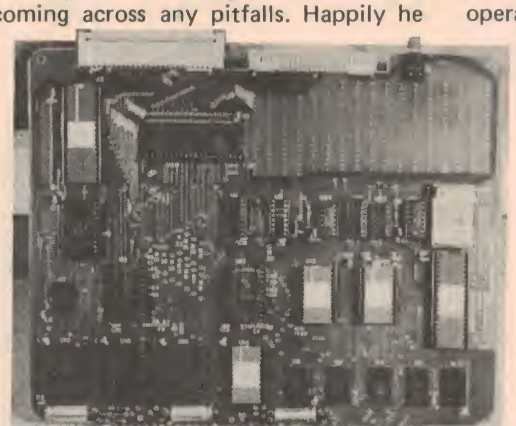
Construction

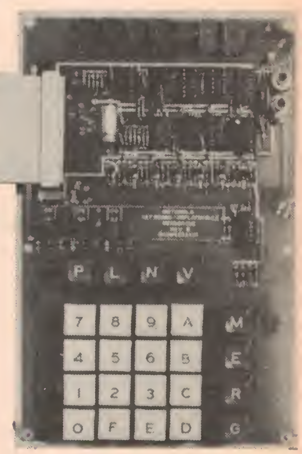
Assembly of the kit proved quite easy, especially easy since one of us gave it to his younger brother who was eager to work on a microcomputer. Being somewhat less experienced in construction technique he had a greater chance of coming across any pitfalls. Happily he found none, although he did find a few spare 10 k resistors. It should also be pointed out he was threatened with dire consequences if he did not study (in depth), the assembly manual first, an exercise essential for this type of kit.

There is very little written text on how to assemble the kit, but there is a pc board overlay (and circuit diagram) to tell you where everything goes. A page is devoted to advice on handling MOS devices and a six-step program is included on making up the 50-wire interconnecting cable. Some people have had difficulty with this cable, so be careful. The problem appears to have been caused by lack of attention when positioning the wire over the pins in the plug, and so causing shorts.

Even for the veteran kit builder, there was still that feeling of excitement as power was applied to the finished kit and an air of anticipation as we watched with our eyes glued to the display for the first observable proof that the kit worked.

Excitement grew as each command was tried and pronounced working till finally all the keys had been checked and the D2 pronounced fully operational.



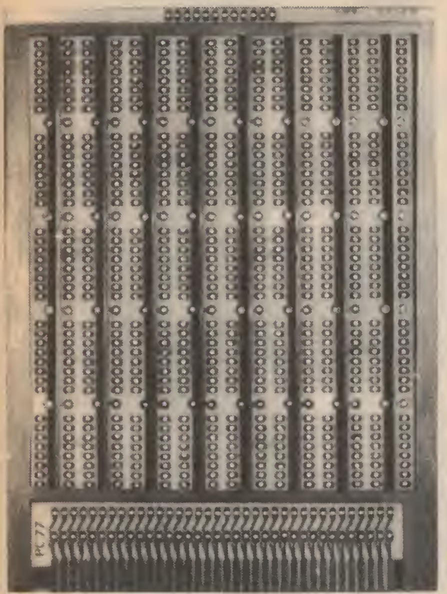


Put together correctly the finished kit looks like this. Now all you have to do is connect up a power supply , learn the 6800 instruction set and get set for hours and hours of computing fun.

D2's PARTS LIST

2	Printed Circuit Boards		6	7 Segment LED Display	DL704
1	Microprocessing Unit (MPU)	MC6800	1	Dual 4-Channel Data Selector	MC14539BCP
1	MCM6830 (JBUG)	SCM44520P	1	Dual Monostable Multivibrator	MC14538BCP
1	3-State Hex Driver	MC8T96	2	Dual D Flip-Flop	MC14013BCP
1	One-of-Eight Decoder	MC74155P	1	Quad 2-input AND Gate	MC14081BCP
3	Random Access Memory (RAM) (128 x 8)	MCM6810	1	Quad Analog Switch	MC14016BCP
			1	Quad Op-Amp	MC3301P
1	614.4 kHz Clock	MC6871B	1	Dual Line Receiver	MC75140P1
1	12-Bit Binary Counter	MC1404BCP	1	Seven Stage Ripple Counter	MC14024BCP
2	Peripheral Interface Adapter (PIA)	MC6820	1	Analog Multiplexer/Demultiplexer	MC14053BCP
1	Quad 2-Input NAND Gate	MC7400P	8	Transistors	
1	Asynchronous Communications ACIA)	MC6850	70	Resistors	
			25	Switches	
1	Dual D Flip-Flop	MC7479P	49	Capacitors	
1	Binary Counter	MC8316P	13	Sockets	
3	Peripheral Driver	MC7542P	1	Cable, 50-Conductor, 3-Foot Length	

NEW PRODUCTS



Applied Technology seems to have taken last month's wrap article to heart and has made available a new low-cost wire wrap board.

It's designed to hold up to forty 16-pin IC sockets and has tracks on both sides of the board for the different power rails. The board plugs into a 0.1 inch pitch, 72 pin (2 x 36) socket and is 110 mm wide (same width as the SC/MP evaluation kit board) by 165 mm high. According to Applied Technology, an IC count of forty was chosen as this is the number of ICs required to implement a 4K memory board of 2102 static RAMs. The board is priced at $9.50.

Also new from Applied Technology is a cassette interface for recording data with the family tape recorder. It uses the CUTS format of 1200 Hz for a logical zero, 2400 Hz for a logical one and a transfer rate of 300 baud.

However, due to its design, it can also handle data at the 100 baud rate which makes it suitable for use with microprocessor evaluation kits.

There was insufficient time this month for a full report, but it's currently hooked up to the Editor's computer and we will report on its performance in the next issue, after it has transferred a few million bytes!

THE INTEL MEMORY DESIGN HANDBOOK (1975) contains information on the use of Intel's memory and memory support ICs. It is intended for those who want to design memories for computers and so tries to provide a thorough understanding of the operation and characteristics of Intel memory devices.

The book of some 230 pages is divided into six chapters:

This book can be best summed up as a data book on memory ICs with considerable and valuable application information. The book was published in 1975 and so contains no details on the newer 16K dynamic and 4K static RAMs.

THE INTEL 8080 MICROCOMPUTER SYSTEM USER'S MANUAL is a 220 page book packed with data on the 8080 microprocessor chip and the support ICs that turn the 8080 chip into a microcomputer. Its a book for those who want a complete and detailed understanding of the 8080.

A number of timing charts are used to aid understanding and there is a section with a full explanation of the instruction set. Chapter 1 has four pages describing the functions of a computer. Chapter 2 has twenty pages on the operation of the 8080 IC. Chapter 3 has ten pages on interfacing the 8080. Chapter 4 has fifteen pages on the 8080 instruction set. Chapter 5 has one hundred and seventy four pages of data sheets on the 8080 and it's twenty six support ICs.

Each book is available by mail from the Sydney office of A.J. Ferguson 34 Herbert Street, West Ryde, NSW 2114 for $5.00 plus $1 post and packaging.

NEWS

WHATS IN A NAME?

People quite often choose company names to be distinctive and to be representative of the products they deal in. If this is the case what are we meant to make out of the name of this magazine: it's a reference journal for users of home computers and carries the name 'Dr Dobbs Journal of COMPUTER Calisthenics & Orthodontia'. It's a magazine heavily into software and publishes things like complete source listings of Tiny BASIC and computer games. Single copies cost $1.50 and can be obtained from Box 310, Menlo Park, CA 94025, USA.

MORE MPUS MOVE INTO CARS

Now Chrysler Corp (USA) have announced that RCA and Texas Instruments are to supply improved versions of their standard MPU with memory and custom I/O for engine control, possibly for the 1979 range of cars.

Although no production contracts have, as yet, been awarded the announcement means both RCA and Texas have strong possibilities of becoming the eventual volume suppliers. With this volume expected to exceed one million chip sets per year by the early 1980s competition between suppliers must only be described as fierce.

IT DOES COMPUTE

Compute is the monthly publication of the national semiconductor microprocessor user group, for which a life-time subscription is available for the measly sum of $15. Through Compute, subscribers are advised of the latest in software and hardware innovations for IMP, PACE, SC/MP and now the 8080 microprocessors.

National Semiconductor of Australia have advised us that software mentioned in Compute is now kept on file in Australia and is available from NS Electronics Pty Ltd, Cnr Stud Road & Mtn Highway, Bayswater, Victoria 3153.

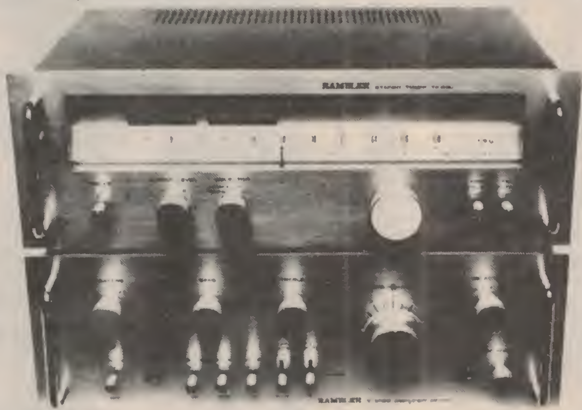
One example of this software is NIMBOL, National's tiny BASIC interpreter for SC/MP, of which an object code version is available for $15.

A lot of Hi-Fi's are just heartless stereotypes.

Sure they can look like a million dollars. And could cost the manufacturers close to it — for design, facia dyes, knurled knobs, toggle switches and two tone timber.
But what's really missing is the timbre.
At Rambler, we know what counts, when it comes to sound performance. It's heart.
Not that our equipment is wanting for clean functional design either . . .
It's just that we have our priorities right, to give you good sound.
Without wasting money on gauche gadgetry. Which means you save money. Lend an ear to this Rambler Integrated Amplifier model AK635 with the Rambler AM/FM Stereo Tuner Model TK600.

TK600
This tuner is brushed silver finish, to match the AK635 Amp, features rack style handles, variable output control, 75 ohm coaxial cable terminal, PLL-MPX demodulator, FET front end, High blend switch.

AK635
This amplifier features 40w x 40w (8 ohms), Multi-Speaker switching. Bass and Treble dual control, separate volume and balance controls, stereo head-phone output, mike input and mike mixing, 2 tape system for dubbing, separate pre and main Amp operation, rack style handles, subsonic filter.



Big Hearted Sound
Big Hearted
Price

RAMBLER
Backed by the Sun Electric Company Pty. Ltd.

New from Altec . . .

From the leader in Studio Monitors . . . the new standard for the discriminating listener. All cabinets are natural North American hardwood veneers, hand-rubbed and oiled. Two-way and three-way systems. Choice of grille colours on selected models.

SPEAKER COMPONENTS	MODEL ONE	MODEL THREE	MODEL FIVE	MODEL SEVEN	MODEL NINE
LOW FREQUENCY:	8" bass driver	10" bass driver	12" bass driver	12" bass driver	12" bass driver
MID FREQUENCY:				6½" frame cone driver	6½" frame cone driver
HIGH FREQUENCY:	4" frame cone driver	4" frame cone driver	2 each 4" frame cone drivers	4" frame cone driver	5" frame cone driver
NOMINAL IMPEDANCE:	8 ohms	8 ohms	8 ohms	8 ohms	8 ohms
CROSSOVER FREQUENCY:	3000 Hz	1500 Hz	1500 Hz	850 Hz, 8 kHz	800 Hz, 7 kHz
ENCLOSURE TYPE:	Sealed	Vented	Vented	Vented	Vented
FREQUENCY RESPONSE:	50 Hz to 20 kHz	50 Hz to 20 kHz	45 Hz to 20 kHz	45 Hz to 20 kHz	40 Hz to 20 kHz
OPERATIONAL POWER RANGE: Recommended for use with amplifiers between these levels	12 watts to 75 watts, 30 watts continuous	10 watts to 100 watts 35 watts continuous	12 watts to 150 watts 45 watts continuous	15 watts to 200 watts 50 watts continuous	12 watts to 250 watts 60 watts continuous
FINISH:	Hand-rubbed oiled oak	Hand-rubbed oiled oak	Hand-rubbed oiled walnut	Hand-rubbed oiled walnut	Hand-rubbed oiled oak
GRILLE:	Acoustically transparent brown knit fabric mounted on removable frame	Acoustically transparent black knit fabric mounted on removable frame	Acoustically transparent black knit fabric mounted on removable frame	Acoustically transparent foam mounted on removable panel. Choice of black, brown, blue, or burnt orange	Acoustically transparent foam mounted on removable panel. Choice of black, brown, blue, or burnt orange
DIMENSIONS:	53.3cm H x 29.2cm W x 26.4cm D	60.9cm H x 31.8cm W x 29.2cm D	64.8cm H x 36.8cm W x 30.5cm D	63.5cm H x 40.6cm W x 35.9cm D	67.3cm H x 44.5cm W x 38.1cm D
WEIGHT:	10.4 kg	12 kg	14.5 kg	20 kg	25.4 kg

RON CHAPMAN HI-FI

NEWCASTLE'S MAILORDER SPECIALIST. — 880 HUNTER STREET, NEWCASTLE 2302. PHONE: 69 2733.

E E E

ELECTRONIC ENTHUSIASTS EMPORIUM

Shops 2 & 3 Post Office Arcade, Pendle Hill, NSW.
P.O. Box 33, Pendle Hill, NSW. 2145.
(02) 636-6222 9-5 Mon-Frid. Sat. 12 noon.

Trade and Export Enquiries Welcome

OUR RANGE COVERS ONE OF THE BIGGEST SELECTIONS IN AUSTRALIA

CA3012	4.60	CD4070	.55	LM377N	3.50	SL622C	26.90	7824CP	
CA3013	5.80	CD4071	.55	LM379	7.50	SL623C	17.40	7400	.48
CA3018	3.50	CD4072	.55	LM380N	2.75	SL624C	8.80	7401	.48
CA3023	6.80	CD4075	.55	LM381N	3.20	SL630C	6.90	7402	.48
CA3028A	2.60	CD4076	1.25	LM382N	2.60	SL640C	10.60	7403	.48
CA3035	5.20	CD4078	.55	LM387N	2.75	SL641C	10.60	7404	.48
CA3039	2.10	CD4081	.55	LM395K	6.90	SL645C	12.60	7405	.48
CA3046	LM3046	CD4082	.55	LM555CN	1.20	SL901B	3.90	7406	1.09
CA3053	1.70	CD4085	1.65	LM555H	1.95	SL917B	6.50	7407	1.09
CA3059	8.40	CD4086	1.65	LM556N	2.95	SL1310	1.60	7408	1.09
CA3060	8.40	CD4093	1.80	LM562B	10.90	SL3046	1.20	7409	.48
CA3079	4.40	CD4502	2.70	LM565N	3.50	SP8505	8.60	7410	.48
CA3080	2.10	CD4503	1.40	LM566CN	2.50	SP8515	12.90	7411	.54
CA3081	2.70	CD4510	3.20	LM567CN	3.50	TAA300	2.90	7413	1.15
CA3082	2.70	CD4511	3.30	LM709N	.95	TBA750	2.90	7414	2.70
CA3083	2.90	CD4514	6.50	LM710CN	1.25	TBA700	4.90	7416	1.00
CA3086	LM3086	CD4515	6.50	LM710CH		TBA810A	4.90	7417	1.15
CA3089E	2.90	CD4516	3.20	LM723H	1.70	TB1750A	3.90	7420	.48
CA3090Q	6.90	CD4518	2.85	LM723N	1.25	TCA220	2.25	7422	1.95
CA3091	18.00	CD4519	1.35	LM725N	5.90	TCA290A	4.90	7425	.95
CA3120E	4.50	CD4520	2.55	LM733CH	2.70	TCA420A	4.90	7426	.70
CA3127E	4.50	CD4528	1.80	LM733N	2.50	TCA580	6.50	7427	.66
CA3128E	9.90	CD4539	1.98	LM741CH	1.20	TCA730	6.90	7430	.48
CA3130T	2.25	CD4555	1.80	LM741CN	.75	TCA740	6.80	7432	.66
CA3140T	2.25	CD4556	1.80	LM747CH	2.70	TDA1005	5.50	7437	.90
CA3600	3.30	CD4720	12.60	LM747CN	2.50	UAA170	3.25	7438	.90
CD4000	.55	CD4724	3.85	LM748CN	1.20	UAA180	3.25	7440	.48
CD4001	.55	CD40097	1.80	LM1303N	2.60	UA723C	LM723	7441	2.80
CD4002	.55	CD40098	1.80	LM1310N	3.50	UA757	3.80	7442	2.60
CD4006	2.30	CD40174	2.90	LM1458N	2.50	ULN2208	2.45	7445	2.60
CD4007	.55	CD40175	2.90	LM1488N	6.90	ULN2209	2.45	7446	2.60
CD4008	2.35	CD40192	2.90	LM1489N	5.75	ULN2111	2.10	7447	2.60
CD4009	1.50	CD40194	2.90	LM1496N	1.90	74C00	.55	7448	2.60
CD4010	1.50	CD40195	2.90	LM1808N	3.90	74C02	.80	7450	.48
CD4011	.55	DM8097	1.90	LM3028	CA3028	74C04	.55	7451	.48
CD4012	.55	HEF see"CD"		LM3046	3.60	74C10	.65	7453	.48
CD4013	.90	LH0070	6.20	LM3086	3.75	74C14	2.80	7454	.48
CD4014	2.40	LM114H	4.90	LM3900	1.75	74C20	.75	7460	.48
CD4015	2.40	LM301AN	.95	LM3905	3.90	74C85	3.90	7470	.85
CD4016	.90	LM301CN	.95	LM3909	1.50	74C86	2.00	7472	.75
CD4017	2.25	LM304H	3.80	MC1035P	2.90	74C90	2.50	7473	.80
CD4018	2.25	LM305AH	3.80	MC1312P	4.80	74C154	5.70	7474	.95
CD4019	2.25	LM307N	1.60	MC1314P	6.90	74C160	3.60	7475	1.35
CD4020	2.50	LM308V	2.20	MC1315P	10.75	74C162	4.50	7476	.90
CD4021	2.25	LM309K	2.60	MC1350P	1.95	74C174	2.50	7480	1.60
CD4022	2.15	LM310N	3.90	MC1351P	3.60	74C192	2.80	7482	2.30
CD4023	.55	LM311A	3.60	MC1454G	5.40	74C901	1.95	7483	2.30
CD4024	1.75	LM311H	3.60	MC1458	LM1458	74C925	16.70	7485	2.95
CD4025	.55	LM312H	4.90	MC1468L	6.50	80C95	2.20	7486	.85
CD4026	3.30	LM317K	6.90	MC1488	LM1488	MISC		7489	4.50
CD4027	1.05	LM318N	5.90	MC1496K	2.75	AL5352	1.50	7490	.90
CD4028	1.80	LM319H	7.25	MC1590G	6.75	GL4484	1.80	7491	1.90
CD4029	2.65	LM319N	5.90	MC14553	12.50	GL5253	.90	7492	1.20
CD4030	.95	LM320K	6.90	MC1648P	4.90	OL31	.90	7493	1.20
CD4031	4.70	LM320T	4.50	MC4044P	4.90	RL4484	.39	7494	2.20
CD4035	2.35	LM322N	4.50	OM802	3.20	RL5023	.35	7495	1.65
CD4040	2.50	LM323K	7.90	SAJ110	2.50	FND357	3.50	7496	2.15
CD4041	2.50	LM324N	4.50	SAK140	2.50	FND500	3.50	74100	3.65
CD4042	1.95	LM325N	4.50	SD305DE	1.30	9001	1.80	74107	.95
CD4043	2.25	LM326H	4.50	SD306DE	1.50	9368	3.85	74121	1.20
CD4044	2.25	LM339N	3.70	SL415A	2.70	9601	2.90	74122	1.20
CD4045	3.20	LM340K	4.95	SL425A	1.80	NSN71	2.90	74123	1.40
CD4046	3.20	LM340T	2.70	SL437D	3.60	NSN74	2.90	74132	1.90
CD4047	1.95	LM349N	4.50	SL440	1.90	TIL306A		74141	2.75
CD4049	.90	LM358N	3.20	SL442	2.90	11C90	18.50	74145	2.95
CD4050	.90	LM370H	4.95	SL447	4.90	95H90	14.50	74150	3.25
CD4051	2.25	LM371N	3.90	SL449	1.60	2102-2	3.75	74151	2.20
CD4052	2.25	LM372H	7.50	SL610C	7.25	2513N	17.50	74153	1.95
CD4053	2.25	LM372N	4.50	SL612C	7.25	S1883		74145	3.20
CD4066	1.45	LM373N	4.70	SL613C	12.50	S50242	15.00	74157	2.20
CD4068	.55	LM374N	4.90	SL620C	9.50	MA1002	13.50	74160	2.75
CD4069	.60	LM375N	4.90	SL621C	9.50	7805CP	2.90	74164	2.90

In some instances pin for pin substitutes will be supplied.

SEMICONDS		BC549C	.55						
AC125	1.80	BC559	.55	MPF102	.65	2N3053	1.20	2N5458	MPF104
AC126	1.80	BC639	1.20	MPF103	.85	2N3054	1.70	2N5459	MPF105
AC127	1.80	BC640	1.20	MPF104	1.10	2N3055	1.35	2N5485	MPF106
AC128	1.80	BD131	1.20	MPF105	.65	2N3564	.65	2N5590	MPF603
AC132	1.50	BD132	1.60	MPF196	1.15	2N3565	.55	2N5591	11.30
AC187	1.50	BD139	1.20	MPF121	1.60	2N3566	.95	2N6027	1.35
AC188	1.50	BD140	1.20	MRF603	6.90	2N3568	.95	2N6084	21.00
AD149	2.60	BD237	1.80	TIP31C	1.20	2N3569	.50	BA102	.80
AD161/62	4.50	BD238	1.80	TIP32C	1.30	2N3638	.55	OA47	.60
AS322	.18	BD437	2.80	TIP120	3.20	2N3638A	.60	OA90	.35
AT118	2N301	BD438	2.80	TIP125	3.30	2N3642	.55	OA91	.35
ASY17	2.65	BF173	1.25	TIP141	4.70	2N3643	.55	5082-2800	3.20
BC107	.35	BF180	1.20	TIP2955	1.70	2N3694	.65	40440	2N3731
BC108	.35	BF194	.85	TIP3055	1.70	2N3731	5.95	40637A	2.85
BC109	.35	BF200	1.30	TT800	2N4037	2N3819	1.35	40673	1.95
BC177	.40	BFY50	1.20	TT801	1.20	2N3866	2.75	40822	2.90
BC178	.40	BFY51	1.50	2N301	2N2869	2N4037	1.25	40841	1.90
BC179	.40	BPX25	4.90	2N706A	1.20	2N4249	.65	BZX61	.75
BC182	.40	BSX19	.75	2N918	1.60	2N4250	.65	BZX70	1.50
BC212	.50	BU126	3.85	2N2222A	1.20	2N4355	.65	BZY91	12.50
BC327	.55	MFE131	1.95	2N2646	2.50	2N4356	.65	PA40	5.85
BC337	.55	MJ802	8.90	2N2869	2.70	2N4360	.95	PB60	6.50
BC547	.55	MJ2955	2.60	2N904A	1.50	2N5245	.75	MEL12	1.40
BC548	.55	MJ4502	8.90	2N2905	1.20	2N5457	MPF103	FCD820	1.90

RADIO HOUSE

PTY. LTD.

306-308 PITT ST.
&
760 GEORGE ST.
P.O. BOX A108 SYD. SOUTH, 2000

NEED SOMETHING BUT DON'T KNOW WHERE TO BUY IT? THEN COME AND TRY RADIO HOUSE PTY LTD

Ideas for experimenters

These pages are intended primarily as a source of ideas. As far as reasonably possible all material has been checked for feasibility, component availability etc, but the circuits have not necessarily been built and tested in our laboratory. Because of the nature of the information in this section we cannot enter into any correspondence about any of the circuits, nor can we produce constructional details.
Electronics Today is always seeking material for these pages. All published material is paid for — generally at a rate of $5 to $7 per item.

SOUND EFFECT GENERATOR

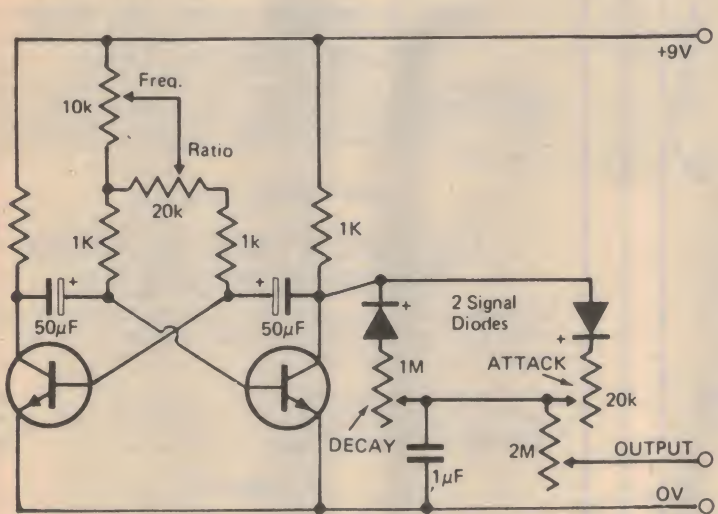
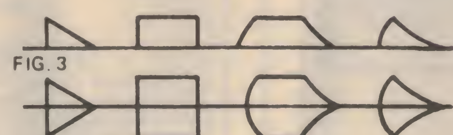


FIG 1

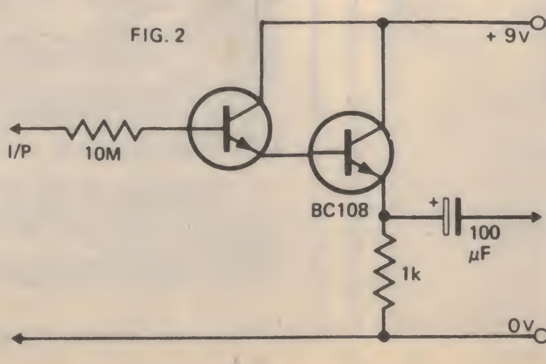
The waveshape generator shown in this circuit will interest those readers experimenting with sound effects.

Basically the circuit is a slow running oscillator with variable attack and decay. A variable amplitude (high impedance) output is available via the 2 meg potentiometer. Figure 2 shows an add-on circuit which should be used if a low impedance output is required.

Some of the output waveforms that can be produced are shown in Fig 3.



AFTER MODULATION

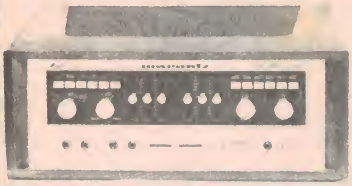


HI-FI HUT

PTY. LTD.

STOCKIST OF Marantz

309 Victoria Road Gladesville 2111
Phone 89-3571



1150 AMP

6300 T/table

HD 77 Speakers

5220 Cassette

THIS SYSTEM AND MANY OTHER MARANTZ COMPONENTS AT PRE-DEVALUATION PRICES.

COME AND SEE US FIRST FOR THE BEST ADVICE IN MARANTZ AND OTHER HI-FI EQUIPMENT.

We open all day Saturday or by appointment

AMATEUR COMMUNICATIONS ADVANCEMENTS

P.O. BOX 57, ROZELLE 2039

SPECIAL OFFERS FOR AMATEURS!

10W BOOSTER AMP. KIT FOR 1W-3W, 2-METRE RIGS

Limited offer. This little beauty uses the MRF 603 and goes FM or SSB! Operates from 12 V, typically gives 10-12W out from 1W drive, draws 2A. Features diode switching. Kit includes instructions, all components, p.c.b., heatsink, metal box, BNC connectors. Size: only 85x60x60 mm.

$28 + $2 p&p, cert. post

TOP QUALITY VHF RF POWER TRANSISTORS BY C.T.C.

This range of quality transistors are fully USWR Protected at maximum ratings. Stud-mounted stripline package. 12V supply. Top of the line, consistent quality, high gain.

B3-12 3W out, 10dB min. gain **$6.50**
B12-12 12W out, 7dB min. gain **$8.50**
B40-12 40W out, 5.5dB min. gain **$18.50**

$32 the set!

Please add $1.00 for cert. p&p.

70CM CONVERTER KIT

Limited quantity. Can't listen on 70cm? Get this converter kit. Another tried and true 6UP kit (remember?). Simple construction and alignment, FET front end, all instructions included. Good performance.

$16 + $2 p&p, cert. post

3W TWO METRE P.A. KIT

So you've built your own 2m TX? Milliwatts of output eh? Get it into the power league. Drive a 10W booster! This kit provides 3W out from as little as 80mW drive; draws 0.4A ea 12 V. Suits SSB or FM. Build on 50x75 mm fibreglass board, features B3-12 CTC transistor. Kit includes p.c.b. all components, transistor & instructions. No metalwork.

$15 + $2 p&p, cert. post

RF POWER DEVICES

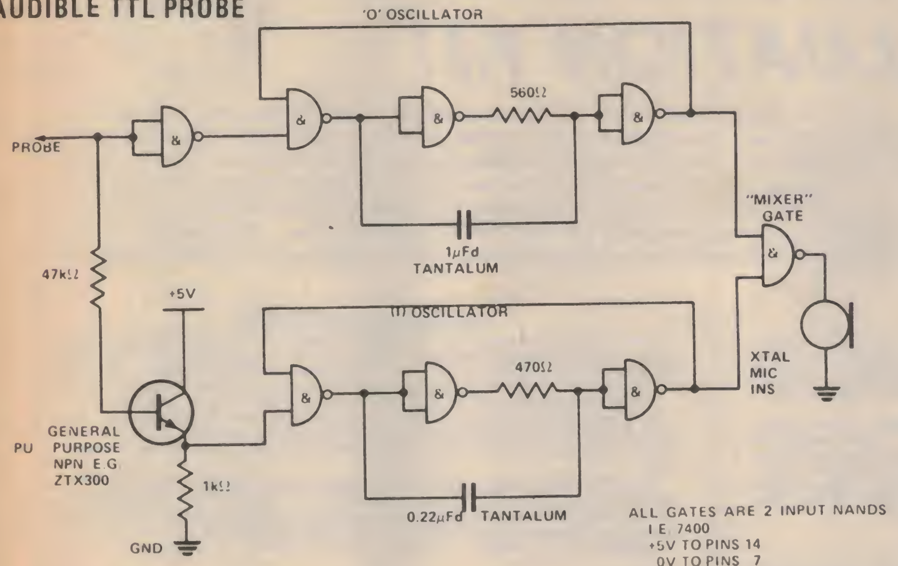
MRF603 — class B or C amp., 10W out, see above. Supplied with data and circuit.
$6.50 + $1 p&p, certo. post.
MRF603 + 'universal' PA board with circuit & layout
$8.50 + p&p.
MA4060 — 40W power varactors. As used in RSGB and ARRL VHF manuals for 432 & 1296 MHz multipliers. Diodes individually tested for series R value (inc.)
$10 + $1 p&p, cert. post.

OTHER KITS STILL AVAILABLE

ETI-710 45W booster amp, improved version **$32 basic kit $38 c/w all metalwork + $2 p&p.**
ETI-707A & B 28,52, 144MHz converter kits 707B (28 or 52) **$13** 707A (144) **$17 + $2 p&p, cert. post.**

Ideas for experimenters

AUDIBLE TTL PROBE

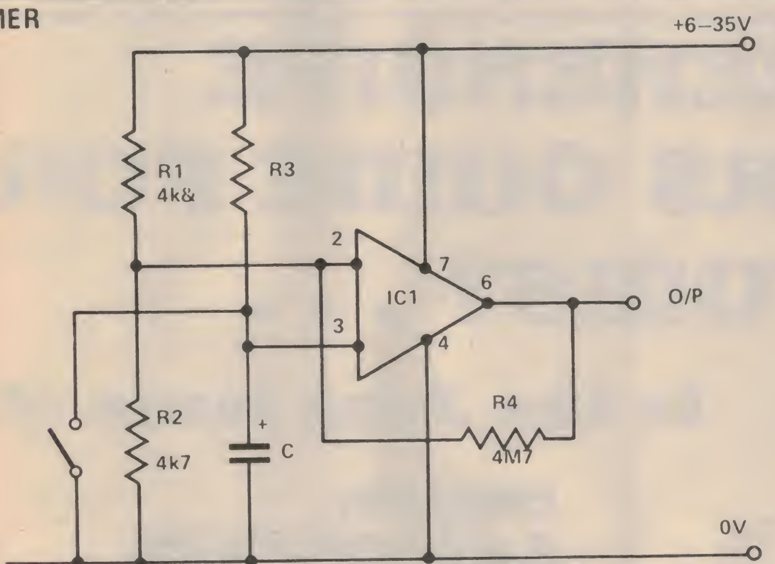


With many LED TTL logic probes it is difficult to watch the LEDs and the circuit one is testing. The following circuit is an attempt to produce a new sort of probe.

When the probe is in contact with a TTL low (0) the probe emits a low note. With a TTL high (I) a high note is emitted.

The whole circuit uses only two TTL ICs and several auxiliary components. This low component count makes it easy to miniaturise the unit. The power is supplied by the circuit under testing so no battery is required.

741 TIMER



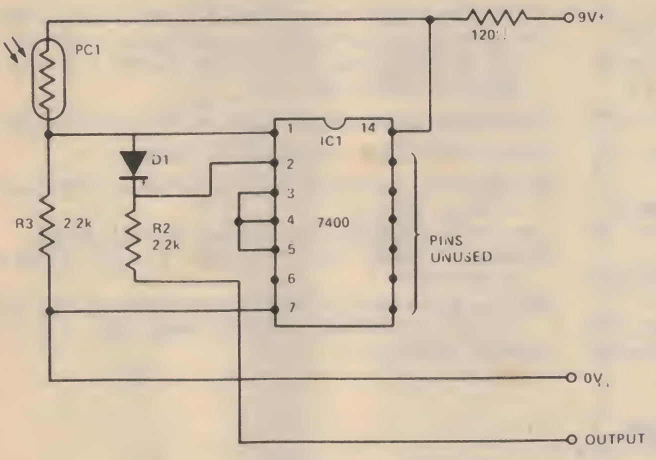
The circuit shows a very simple timer based on a 741 op amp.

R1 and R2 hold the inverting input at half supply voltage. R4 applies some feedback to increase the input impedance at pin 3, but its value is such that negligable damping of pin 2's voltage occurs. Pin 3, the non inverting input, is connected to the junction of R3 and C. After S1 is opened and C charges via R3. When the capacitor has charged up sufficiently for the potential at pin 3 to exceed that at pin 2 the output abruptly changes from 0V to positive line potential. If reverse polarity operation is required simply transpose R3 and C.

R3 and C can be any values and time delays from a fraction of a second to several hours can be obtained by judicious selection. The time delay is 0.7CR seconds where C is in Farads and R in ohms and hence is completly independent of supply voltage.

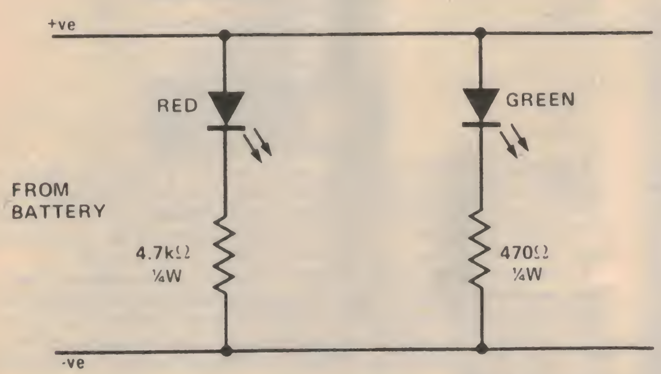
Ideas for experimenters

INTRUDER ALARM



Here two gates of a 7400 are used to provide photoelectric control in conjunction with an ORP 12 photocell. When light falls on PC1 the potential is applied to the trigger circuit consisting of ½ the 7400. The feedback provided ensures a positive output change at pin 6. The output, whilst PC1 is under illumination, is equal to the supply voltage. R1 enables a small 9V battery to be used. If PC1 is shaded the output at pin 6 is 0V. This may now be used to trigger a relay for an intruder alarm. If this is the case it is wise to use a small mains supply and to incorporate a diode across the relay coil, to prevent high back EMF from destroying the IC.

GOOD/NO GOOD BATTERY TESTER



This is a simple tester for use with a PP3 or similar battery.

It is wired to a PP3 battery clip remembering that red is connected to −ve of battery and black to the +ve. It uses 3 small LEDs of the same size: one red, one green. Due to the fact that the green LED needs a far greater current, the green will glow only if the battery is in reasonable condition. The red will glow even if battery is down. If the red glow is very faint the battery is no good.

NEVER TO BE REPEATED

SPECIAL CLEARANCE OF STOCK—WHILE IT LASTS

(10 only) ARIX MULTITESTERS 36QFTR. This beautiful Multimeter has 34 ranges plus transistor tester. Bargain. **$37.37 ea.** plus $2.00 P. & P.

(10 only) Digital Multimeters. B. & K. Model 280. 3 Digit. AC and DC volts, current, ohms. Bargain. **$112.00 ea.** plus $2.00 P. & P.

(100 only) Printed Circuit Boards for 4 amp regulated Power Supply C.W. circuit diagram. **$2.00 ea.** plus 50c. P. & P.

DPDT C/o 240v Mains switches, panel mounting, metal toggle Type C2721. **$1.90 ea.**

DP on/Off 240V Mains switches as above. Type BC 620/C. **$1.00 ea.**

DP Illuminated 240V 10A Rocker Switches Panel Mounting Square Cut Out. **$1.00 ea.**

Miscellaneous miniature pliers, long nose pliers, side cutters. **$4.00 ea.**

Spring Terminals 1 Red, 1 Black on mounting panel. **$0.60c. ea.**

Screw terminals ideal for power supplies. These beautiful terminals suitable for 250V10A. You can wrap round, poke thru or plug 4mm banana plugs into. Yellow, Black, Purple, Red, White, Green. **$0.50c. ea.**

(4 only) Hioki (Same as Peak) Multimeters. Type A-10 with built in Signal Injector. Huge Scale. 6 ins by 3ins. Fantastic number of ranges. **$59.50 ea.** plus $2.00 P. & P.

Multicore Savbit solder pencils. **$0.60c. ea.** These are the refillable ones.

4mm Banana Sockets. Various colours. **$0.50c. pr.**

400V 8A SCR's. Suitable for Drill Speed Controllers, model railways, light dimmers. **$1.50 ea.**

Core Halves. C/W Bobbins, spring clips, Clasps. **$2.00 set.**

Multimeter AS-100DP. Big Meter. Heaps of ranges. **$35.79 ea.** plus $2.00 P. & P.

Miniature dipped Mica Capacitors. Ideal for tuning circuits, oscillators, timers. 5/ 500V Working. Only the following values, 10, 47, 100, 470, 1000 pfd. **$0.25c. ea.**

DIGITRONICS

MUCH MUCH MORE –
IF YOU DON'T SEE IT PLEASE ASK

MINIMUM ORDER $5.00 C.W.O. NO C.O.D.
Please add $1.00 P&P

186 PARRY STREET, NEWCASTLE WEST, NSW 2302 PHONE (049) 69-2040

Want to hear it all out front?

Look on the back.

C.M.A.
FOAM DIVISION
GENUINE
AUDIOFOAM
SPEAKER GRILLE

If you see this label on a speaker system, you can be sure you'll hear all the sound the speaker is delivering. The label tells you the speaker grille is made from genuine Cable Makers AUDIOFOAM, the 100 per cent reticulated foam. And that means it's acoustically transparent . . . like having nothing between you and the speaker. Or, as acoustics experts put it, "as pure as having no grille at all".

Many manufacturers use AUDIOFOAM on their speaker systems. They know that good sound transmission is equivalent to air movement without distortion. Audible sound waves pass through AUDIOFOAM virtually free of distortion, compared with other speaker grille materials. They know, too, that no ordinary grille cloth can match the rich, sculptured good looks of a three-dimensional speaker grille made from AUDIOFOAM.

And next time you look at speaker systems, look for our label on the back. Then listen to the pure, full sound out front.

CABLE MAKERS AUSTRALIA PTY. LTD.
FOAM DIVISION,
Heathcote Road, Liverpool, N.S.W. 2170.

Please Explain

Decibels

What is a dB in terms of a percentage increase in power? What is dB and dBm?
T.J., Melbourne

One decibel increase in power means an increase of approximately 26%. Thus 3 dB = 1.26 x 1.26 x 1.26 = approximately twice the power.

When the effect is logarithmic (such as the effect of sound power changes on the ear: the brain hears the same 'volume difference' between 5 W and 10 W as it does between ½ W and 1 W or 40 W and 80 W) it is useful to measure power differences on a logarithmic scale. Rather than using a sequence like 1, 1.26, 1.6, 2, 2.5, 3.2, 4, 5, 6.35, 8, 10, (which show equal ratio increases) the series 0 dB, 1 dB, 2 dB, 3 dB, 4 dB, 5 dB, 6 dB, 7 dB, 8 dB, 9 dB, 10 dB, can be used.

The number of decibels corresponding to the difference in two power levels $= 10 \log \frac{P2}{P1}$ (Using base 10 logarithms).

The series above can be used to find the power ratio for any number of decibels. You can see directly that 4 dB corresponds to a ratio of 2.5. So if you want to know what 14 dB means consider this as two ratios, 4 dB and 10 dB, which give 2.5 and 10, a total ratio of 25. Or you could have regarded 14 dB as two 7 dB ratios, an increase of five times followed by another of the same ratio, 5 x 5 = 25. It doesn't matter how you split up the 14 dB, you still get a ratio of 25.

In practice if you have a signal-to-noise ratio of 90 dB it means the signal is 1 000 000 000 times more powerful than the noise. Or if you have a radio receiver with an S-meter calibrated every 6 dB, an S3 station radiating 5 W will have to radiate 20 W to make S4. Similarly a 100 W station would have to find another 300 W to have the same effect.

The relationship between decibels and the ear's 'loudness' response is roughly as follows: one decibel is about the smalles change the ear can detect, and 9 dB comes over as a doubling in loudness. So if you choose between two hi-fi amplifiers, one rated at 40 W and one at 50 W, bear in mind that the difference is only just perceptable. And if you buy the 40 W amplifier and discover it's only half as loud as you want, you'd better start saving for a 300 W system!

In audio you don't normally hear of much above 110 dB. That's because the range of hearing from its lower threshold to the threshold of discomfort is only about 110 dB. But without decibels we'd have to talk of power ratios up to 10^{11}. In measuring actual sound levels, such as when checking noise pollution, an absolute scale can be made by referring sound levels to the threshold of hearing (corresponding to a sound-pressure level of 0.0002 microbars).

Another absolute scale is used in audio to compare levels — this time to compare audio signals. Here levels are referred to 1 mW of power (in a 600 ohm line) and the units are called dBm. The VU meters on audio equipment use units also derived from the decibel, when measuring a sinewave a change of 1 dBm produces a metered change of 1 VU.

So a 1 W signal corresponds to 30 dBm, and on a 600 ohm line this would be 24.5 V.

Mini-Mart

We'll print your 24 words (maximum) totally free of charge. Copy must be with us by the 7th of the month preceding the month of issue. Please, **please** write or preferably type your adverts clearly, using BLOCK LETTERS.

If, like many of our readers, you'd prefer not to cut up your copy of ETI, just make a copy of the relevánt part of this page. Please make it the same size as the original — and write your copy using BLOCK LETTERS.

send your ad to —
ETI MiniMart,
Modern Magazines,
15 Boundary Street,
Rushcutters Bay,
NSW 2011.

CRO Telequipment D53 wanted any condition buy or swap plus cash adjustment P. Harle 228 Memorial Ave, Liverpool NSW 2170 Phone 602 7179 before 8.30am.

Stabilised power supplies. ±25V 2.5A +5V 5.0A $100 ±8V 1.0A +5V 10.0A $70. Logic tester $40. D. Smith, 3/120 Fisher Road, Dee Why NSW 2099.

Turntable, "Interdyn Special", semi-auto, equivalent to Yamaha CS-50P in Micro B/C. VGC c6w Lencoclean 'L' cleaner and bottle of fluid $75. Phone 03-85 4070, Jon Jr.

AKAI XV 4 speed 4 track stereo tape recorder mains or rechargeable battery excellent condition. Some tapes included $250. L Mac Donald 317 Eureka Street Ballarat 3350.

74C0 TTL 200 for $40 private stock. Never been used. S. Modra, 10 Jetty Rd Brighton SA 5048. Ph. 268 2500 (work) A.H. 298 4232. Area code (08).

Wanted V.H.F. tuner for Philips 11" portable B/W TV model 11Lx22 also UHF tuner for same Paul Fuller 24 Penman Street New Lambton 2305.

Speakers 1 PR 30W 3-way finished in teak veneer bring along a good record to put them to the test $170 (ono). R. Lore (02) 84 4042 Beecroft.

Melbourne HIFI friends the recording society of Australia meets monthly for demonstrations lectures live — recording etc. Ring for information — Don Patrick (03) 459 1717 after hours.

"SONY" stereo mike line mixer five channels suit pop group tape recordists $150 ono. Phone 0434 12175 "Sony" TC-458 stereo open reel deck $150 ono.

Wanted Schematic for "moody" model GA35 reverb amplifier GR Pettinger .48 Quirke Ave, Whyyalla Stuart 5608. South Australia. Please help. Will pay COD.

Wanted B7k 970 transistor analyst BWD 539C scope price and details T Tivey, 10 Sellar St, Cooma NSW. Ph. 22487.

4 SALE National portable record player 3 band radio stereo good cond. $150 ono. Phone 498-2588 between 5pm and 9pm Weekdays. Ross Jackson.

Wanted help on how to program the HP-25 to do the stopwatch mode write to Ernest Khu, Hawkesbury Agricultural College, Richmond NSW 2753.

Screened 3-strand audio cable 100 metres $48 or will sell odd lengths 22 O'Connor St, Chippendale Sydney. T. de Botte.

SELL E.A. digital frequency counter wired and tested as new 200 MHz $90. G. Oliver, 8 Junction St, Preston 3072.

SELL ETI 422 50w stereo amp nearly completed urgent sale $120 contact G. Topple, 9 Archibald St, Padstow 2211, Syd. 772-3378.

MELBOURNE tape friends. THE RECORDING SOCIETY OF AUSTRALIA meets monthly for lectures and demonstrations. For further information and syllabus ring (AH) (03) 459-1717 or (03) 99-4185.

TWIN 25 amplifier for sale. Dick Smith's kit fully assembled and tested, hardly used. $100 ono. Craig (02) 498 4594.

BWD 539A scope had little use. Perfect condition $345 ono. A. Holley, 5 Hazel St, Portland 2847. Ph. 063-555371.

TRIO OSC never used $150; also two realistic 23-band T'cvers (5 watt) new $190. Bob Larsen, 383 St. Pauls, TCE Valley Brisbane. Ph. 52-5738 A/H 30-1859.
FOR SALE Roland system 100 synthesiser suitable for studio or stage. Includes keyboard, sequencer, expander, mixer. $1400. Peter Torning. 21 Tully Avenue, Liverpool. 602-5218.

FOR SALE ETI 422 stereo 50 w/ch works perfect $160 also ETI 740 tuner $120 contact Glenn Block, 19 Forfar Rd, Hamlyn Heights Geelong 3215 Vic.

WANTED FT75, FT101E or similar HF transceiver 40ft tower, TH3 Yagi or similar. VK2NDP. P.O. Box 192 Baulkham Hills 2153. (02) 639-7962.

FOR SALE oscilloscope dual trace "advance OS250" and colour generator "Grundig FG5" as new still in box (cost over $1200) together $900. Phone (047) 31 5461.

ASC11 flexowriter punch reader keyboard logic unit printer with handbook $175. Buchtmann, 2 Yaralla Cresc. Thornleigh NSW 84-7758.

LABORATORY chart recorder. Excellent condition, 17 Ranges 10mW — 500V, 10μA — 100mA, 1ohm — 100k. 10 Meg. Input. 2% Accuracy five speeds $600. 3/72 Kurruba Rd. Neutral Bay.

WANTED Plessey producermatic 2 cart machine play or rec/play urgent S.P. Marvin, Box 57 Mt. Lawley WA 6050.

FOR ECG experiements defibrillator $100 thermal pen cardiograph $150. All 240V instruments P. Hassett, 54 Sackville St. Maroubra NSW. Tel. (02) 34-6179.

WANTED 2 metre portable transceiver or converted caaphone multi channel preferred. 12V mobile operation handbook or circuit if possible VK2YEP Box 6 Oatley NSW 2223.

WANTED to buy or copy: circuit or manual of H.G. Palmer model 101 TV vintage 1961. M. Lee, 66 Bignell Rd, East Bentleigh Vic 3165.

NEED software to feed your 6800? TSC software package contains 12 games programs plus many others only $45. Pfotenhager 50 Dunn Rd, Rochedale 4123.

QR-666 communications receiver 0.17 to 30 MHz as new $220 or ono. Paul Flat, 8, Lenore Court, Lumley Street, Granville. After 6pm.

IE 33 VDU data terminal $500. SC/MP micro processor $60. Philips C3 video monitor $60 unit, 38/77 Hereford St, Glebe NSW 2037. Phone (02) 692-0679.

WANTED offers for quantity old books and magazines about radio electronics etc; thirty to hundred years old. Bristoe Box Nine P.O. Bangalow 2479

FOR SALE: Magnetic cartridge —shure V15III with eliptical stylus. Never used. Brand new — still in carton new — $98. Price — $65. French's Forest. Phone 451-7257.

CONDITIONS

Name and address plus phone number (if required) must be included within the 24 words allowed.

Reasonable abbreviations, such as 25 Wrms, count as one word.

Private adverts only will be accepted. Please let us know if you find a commercial enterprise using this service.

Every effort will be made to publish all adverts received — however, no responsibility for so doing is accepted or implied.

PLEASE USE BLOCK LETTERS

electronics today SERVICES ADVERTISERS INDEX

READERS' LETTERS

No charge for replies but a foolscap-size stamped addressed envelope must be enclosed. Project queries can only be answered if related to item as published. We cannot assist if project is modified nor if components are otherwise than specified.
We regret we cannot answer readers' enquiries by telephone.

SUBSCRIPTIONS AND BACK ISSUES

ETI subscriptions cost $14.00 per year (incl postage) within Australia. Cost elsewhere is $14.65 (incl postage — surface mail). Airmail rates on application.
Back issues cost $1.00 each plus post and packing.
We can supply **only** the following issues.
1975: Feb., April, Nov., Dec.
1976: May, Nov., Dec.
1977: Jan., Feb., March.
Photostats are available of any article ever published in ETI. We charge a flat $1.00 regardless of page quantity from any one issue of ETI. Thus if the article is in three issues the cost is $3.00. Send orders to address below.

LIABILITY

Whilst every effort has been made to ensure that all constructional projects referred to in this edition will operate as indicated efficiently and properly and that all necessary components to manufacture the same will be available, no responsibility whatsoever is accepted in respect of the failure for any reason at all of the project to operate effectively or at all whether due to any fault in design or otherwise and no responsibility is accepted for the failure to obtain any component parts in respect of any such project. Further no responsibility is accepted in respect of any injury or damage caused by any fault in the design of any such project as aforesaid.

A MODERN MAGAZINES PUBLICATION

Managing Director: Arnold Quick
Secretary: Charles O'Leary
Publisher: Collyn Rivers

PRODUCTION

Art Director: Jim Hattersley
Artist: Maree Stanley
Production Manager: Bob Izzard
Subscriptions & Circulation: John Oxenford
Project Design: Nebula Electronics
Acoustical Consultants: Louis A Challis & Assoc.

ADVERTISING

Sydney: Bob Taylor (Manager), Geoff Petschler (NSW Manager), 15 Boundary St, Rushcutters Bay 2011. Tel: 33-4282.
Melbourne: Tom Bray (Manager), Poppe Davis. Suite 24, 553 St. Kilda Rd, Melbourne. Tel: 51-9836
Brisbane: David Wood, 11-14 Buchanan St, West End, Brisbane. Tel: 44-3485
Adelaide: Ad Media, 68 North Terrace, Kent Town 5067. Tel: 42-4858
Perth: Aubrey Barker, 39 Mounts Bay Rd, Perth. Tel: 22-3184
Tokyo: Genzo Uchida, Bancho Media Service, 15 Sanyeicho, Shintuku-Ku, Tokyo 160
London: Electronics Today International, 25-27 Oxford St, London W1R2NT. Tel: 01 434-1781/2

Electronics Today International is published by Modern Magazines (Holdings) Ltd, 15 Boundary St, Rushcutters Bay NSW 2011. It is printed (in 1977) by Wilke & Co., Browns Rd, Clayton, Victoria and distributed by Australian Consolidated Press.

CB Australia

Technics
where leadership has become a tradition

In 1970 Technics introduced the world's first direct-drive turntable. Since then we have developed a range of turntables universally accepted by professional studios and discerning audio buffs alike.

The heart of the original direct-drive turntable was the precise, low-speed DC servo motor with performance characteristics equal to that of fine record-cutting equipment.

In developing phases a competitively priced tone-arm equipped direct-drive unit brought professional features within the reach of the discriminating hi-fi enthusiast. Then fully automatic operation was combined with the direct-drive principle. A major innovation was the quartz phase-locked SP-10 Mark II — a thoroughly professional unit with amazing performance data (w and f within 0.025% WRMS) and separate power supply.

In 1976 new generation technology such as the Back Electromotive Force Frequency Generator improved speed stability under varying loads. One chip 321-element integrated circuitry to drive and control the DC motor was also implemented.

This year Technics offer you the widest choice of direct-drive turntables to complement your Hi-Fi system — a range reflecting not only the continuing advances of audio concepts but also eye-catching design.

Leadership in the past. We think it's an obligation to provide leadership in the future.

Shown above is the souvenir edition Technics SL-1300 fully automatic turntable presented to Haco Distributing Agencies Pty. Ltd., to celebrate the production of the 300,000th Technics direct-drive turntable.

National **Technics** hi-fi

T77.2

Some slightly lesser decks for a lot less bucks.

CT-F8080

Not everyone is going to rush out and buy the highest priced deck on the market because not everyone needs it. Or wants it. Pioneer knows where you're at.

For those who want to match the best cassette deck available to their present system and budget, we are pleased to announce the return of the "basic" cassette deck. Basically outstanding in tonal quality, basically designed for mechanical precision and basically priced for good value.

While front access design makes them easy to use, advanced Pioneer features make them great to listen to.

Just as an example, in the CT-F8080 a DC servomotor provides accurate record/play speed. A second motor for fast-forward and rewind. As a result, wow/flutter is within ±0.17%.

The long life Ferrite Solid head and Dolby* noise reduction system join to reduce tape noise and deliver excellent high frequency reproduction. Solenoid operated controls are user engineered for convenience and advanced equalizer circuitry accommodates any type of tape commercially available today.

In the CT-F7070 and CT-F6060, many of these impressive features are available at equally impressive prices. Proving once again, that we're listening to what you want to listen to.

Pioneer's basic cassette decks. Created for those who want to buy only what they need. So, in this case less is more.

	Cassette Position	Drive System	Control Operation	Tape Selector	Wow & Flutter	Signal/Noise Ratio	Frequency Response
CT-F8080	Vertical	2 motors	Solenoid	Independent BIAS, EQ	Within 0.17% (DIN)	Dolby OFF: 53dB Dolby ON: 63dB (normal tape over 5kHz)	20–16,000Hz 30–13,000Hz (±3dB)
CT-F7070	Vertical	1 motor	Mechanical	Independent BIAS, EQ (automatic chrome-tape selector)	Within 0.19% (DIN)	Dolby OFF: 52dB Dolby ON: 62dB (normal tape over 5kHz)	30–14,000Hz 40–13,000Hz (±3dB)
CT-F6060	Vertical	1 motor	Mechanical	Independent BIAS, EQ (automatic chrome-tape selector)	Within 0.2% (DIN)	Dolby OFF: 52dB Dolby ON: 62dB (normal tape over 5kHz)	30–14,000Hz 40–13,000Hz (±3dB)

*Dolby is the trademark of Dolby Laboratories, Inc.

Pioneer Electronics Australia Pty. Ltd.
178-184 Boundary Road, Braeside, Victoria 3195 Phone: 90-9011, Sydney 93-0246, Brisbane 52-8231, Adelaide 433379, Perth 76-7776.

PIONEER
leads the world in sound.